

Contents

□ Key Points from MIL-STD-11991B	2
□ Why this matters for your work	2
□ Overview & Scope	3

□ Statement & Metadata Analysis	3
□ Management Information System (MIS)	3
□ Investigation Principles	3
□ Auditing with Visual Basic, Logigram, Algorigram	4
□ Research Methodology	4
□ Integration with Related Specifications	4
Suggested Next Step	4
□ Scope of MIL-STD-11991B	5
□ Metadata & Document Context	5
□ Key Definitions (Section 3)	5
□ Auditing & MIS Integration	5
□ Research & Investigation Principles	6
□ Practical Tools for You	6
□ Concluding Material	6
Data requirements overview for MIL-STD-11991B incoming inspections ..	6
Table 1: PM&P incoming inspection data requirements (Appendix H, H.2.1)	6
Table 2: Electronic components inspection and test (Appendix F, Table F-I)	8
Minimal data model for the incoming inspection database	8
Quick notes you can embed in your algorigram/logigram	9
□ Table A-VI. Microcircuit Derating Factors	9
□ Table A-IV. EMI Filter Derating Factors	9
□ Table A-I. Capacitor Derating Factors	10
□ Table A-II. Crystal Oscillator Derating Factors	10
□ Table A-III. Diode Derating Factors	10
□ Table A-VII. Optoelectronic Device Derating Factors	11
□ Table XXXI. Fungi Susceptibility of Materials	11
□ Table VII. Resistor and Thermistor Specifications	12
□ Table VIII. Switch Specifications	13
□ Table IX. Waveguide Reference Documents	14
□ Capacitor Styles and Application Considerations (Table extract, §5.2.2)	15
□ Table IV. Hermetic Microcircuit and Semiconductor Requirements	15

□ Table V. Plastic Encapsulated Microcircuit and Semiconductor Requirements.....	16
□ EMI & RFI Filters (Section 5.2.6).....	16
□ Table 1. Documented Procedures & Quality System Requirements (Section 4.3).....	17
□ Table 2. Life Cycle Management Requirements (Section 4.4).....	17
□ Table 3. COTS & Subcontractor Management (Sections 4.5-4.6).....	18
□ Table 4. Parts Requirements (Section 5.2).....	18
□ Table I. Equipment Categories and Definitions.....	19
□ Table II. Life Cycle Stresses.....	19
□ Key Definitions from MIL-STD-11991B (Section 3).....	21
□ General Drawing Practices.....	22
✗ Electrical & Electronic Specific Standards.....	23
□ Key Non-Government Standards (Adopted by DoD).....	23
□ Related Standards You Mentioned.....	23
□ Why These Standards Matter.....	23
□ Purpose & Scope.....	24
□ Key Sections (from the contents).....	24
□ Core Concepts.....	24
□ Why It Matters.....	25
□ Method 105C — Barometric Pressure (Reduced Pressure Test).....	25
□ Method 106G — Moisture Resistance.....	26
□ Method 107G — Thermal Shock.....	26
Table 107-I. Thermal Shock (Air).....	26
Table 107-III. Thermal Shock (Liquid).....	26
Table 107-IV. Suggested Thermal Fluids.....	27
□ Method 202D (Canceled, replaced by Method 213).....	27
□ Method 203C — Random Drop Test.....	27
□ Method 204D — High-Frequency Vibration Test.....	28
□ Standard Mounting Fixtures (Figure 207-4A / 4B).....	28
□ Controller Parts Mounting (Figure 207-5).....	29
□ Deck/Platform Mounted Parts (Figure 207-6).....	29
□ Why This Matters.....	30
□ Standardization Document Improvement Proposal (DD Form 1426).....	30
□ MIL-STD-202G, Method 310 — Contact Chatter Monitoring.....	30

□ How the Proposal and Method Tie Together	31
□ Method 308 — Resistor Noise Measurement	31
□ Method 217A — Particle Impact Noise Detection (PIND)	32
□ Why These Methods Matter	33
□ Method 214A — Random Vibration Test (Overview)	34
□ Table 214-I. Test Condition I (Random Vibration)	34
□ Table 214-II. Test Condition II (Random Vibration)	35
□ Why This Matters	35
□ Method 211A — Terminal Strength Test (Overview)	35
□ Test Conditions	35
□ Procedures	36
Condition A — Pull Test	36
Condition B — Flat-Terminal Bend Test	36
Condition C — Wire-Lead Bend Test	36
Condition D — Twist Test	36
Condition E — Torque Test	36
□ Measurements	37
□ Why This Matters	37
□ NIJ Body Armor Standard — Key Sections	37
1. Purpose and Scope	37
2. NIJ Body Armor Classification	37
3. Definitions	38
4. Sample Requirements & Laboratory Configuration	38
5. Flexible Armor Conditioning Protocol	38
6. Hard Armor Conditioning Protocol	38
7. Ballistic Test Methods	38
8. References	38
□ Why This Matters	39
□ NIJ Ballistic Armor Classifications	39
□ Key Definitions	40
You said	40
Copilot said	40
□ What MIL-STD-810 Is	40
□ Evolution	41

🔑 Key Principles	41
📄 Why It Matters	41
You said	41
📄 Part Three - Climatic Regions	42
📄 Applicability to Ruggedized Consumer Products	42
📄 Related Documents	42
📄 See Also	42
Rapid start: Excel VBA to normalize pasted article text into a checklist	43
VB.NET console: extract headings and emit CSV for audit	45
What I need to tailor it perfectly	47
📄 VBA Macro: Parse MIL-STD-810 Text into Audit Checklist	47
📄 How It Works	49
Copilot said	49
📄 Excel VBA Macro: Build MIL-STD-810 Audit Checklist	49
📄 How to Use	51
Synthesis of Key Compliance, Engineering, and Documentation Requirements from MIL-STD-100G and IEC 62368-1:2024 for Electrical and Electronic Product Design.	51
Introduction.....	51
Scope and Applicability: MIL-STD-100G vs. IEC 62368-1:2024.....	52
MIL-STD-100G.....	52
📄 How It Works	54
Copilot said	54
📄 Excel VBA Macro: Build MIL-STD-810 Audit Checklist	54
📄 How to Use	56
You said	57
Copilot said	57
📄 Excel VBA Macro: Extract Q&A from Sheet and Normalize for Audit or Study	57
📄 What This Enables	58
You said	59
Copilot said	59
Synthesis of Key Compliance, Engineering, and Documentation Requirements from MIL-STD-100G and IEC 62368-1:2024 for Electrical and Electronic Product Design	59

Introduction..... 59

Scope and Applicability: MIL-STD-100G vs. IEC 62368-1:2024.....60

MIL-STD-100G..... 60

IEC 62368-1:2024.....60

Comparative Analysis..... 60

Drawing Practices and Formats..... 61

Drawing Practices in MIL-STD-100G.....61

Drawing Practices in IEC 62368-1:2024.....61

Comparative Table: Drawing and Documentation Practices.....62

Engineering Change Control, Numbering, and Identification.....63

MIL-STD-100G Requirements..... 63

IEC 62368-1:2024 Requirements..... 63

Comparative Analysis..... 63

Safety Documentation and Hazard-Based Risk Assessment.....64

MIL-STD-100G: Critical Safety Characteristics and Items.....64

IEC 62368-1:2024: Hazard-Based Safety Engineering (HBSE).....64

Comparative Table: Safety Documentation and Risk Assessment.....65

Qualification Procedures and Testing Requirements.....65

MIL-STD-100G: Qualification for Source Control Drawings.....65

IEC 62368-1:2024: Testing and Certification.....66

Comparative Table: Qualification and Testing.....66

Intersections for Ruggedized and Safety-Critical Systems.....67

Common Requirements.....67

Unique Considerations..... 67

Manufacturing, Supplier, and Part Documentation Requirements.....68

MIL-STD-100G..... 68

IEC 62368-1:2024..... 68

Qualification Records, Test Reports, and Traceability.....68

EMC, Thermal, Mechanical, and Environmental Considerations.....69

MIL-STD-100G..... 69

IEC 62368-1:2024..... 69

Marking, Labelling, and User Information.....69

MIL-STD-100G..... 69

IEC 62368-1:2024..... 69

CAD, Digital Data Exchange, and Electronic Deliverables.....69

MIL-STD-100G..... 69

IEC 62368-1:2024..... 70

Tailoring, Contractual Application, and Order of Precedence.....70

MIL-STD-100G..... 70

IEC 62368-1:2024..... 70

Regulatory and Certification Pathways.....70

MIL-STD-100G..... 70

IEC 62368-1:2024..... 71

Change Management and Configuration Control for Safety-Critical Systems..... 71

MIL-STD-100G..... 71

IEC 62368-1:2024..... 71

Human Factors, Instructions for Use, and Maintenance Documentation 71

MIL-STD-100G..... 71

IEC 62368-1:2024..... 72

Component Selection, Substitution, and Approved Item Names.....72

MIL-STD-100G..... 72

IEC 62368-1:2024..... 72

Integration with Functional Safety Standards.....72

Comparative Table: Key Dimensions and Clauses.....72

Conclusion and Recommendations.....73

Appendix: Summary Table—MIL-STD-100G vs. IEC 62368-1:2024.....74

References.....75

You said.....77

Copilot said.....77

□ Research Report (Markdown Structured).....77

Title..... 77

1. Scope..... 77

2. Drawing Practices..... 77

3. Safety Documentation..... 78

4. Qualification Procedures..... 78

5. Comparative Analysis..... 78

□ Visual Basic Code Snippet..... 78

Visual Basic quiz engine with logigram and algorigram.....	80
Overview.....	80
Logigram workflow.....	80
Algorigram decision logic.....	80
VBA modules.....	81
1) Data model and loader (Module: modQuiz).....	81
2) Optional: UserForm front-end (UserForm: frmQuiz).....	84
Export: results and audit trail (Module: modExport).....	85
How this maps to your themes.....	86
Visual Basic logigram and algorigram toolkit for clustered notebooks and audit-ready workflows.....	86
Overview.....	86
Logigram: End-to-end workflow.....	86
Algorigram: Core decision logic.....	86
VBA modules.....	87
1) Data model and clustering (Module: modModel).....	87
2) Rules engine and metrics (Module: modRules).....	88
3) Dashboard and export (Module: modDashboard).....	89
4) Controller and flow painter (Module: modController).....	90
Audit-ready checklist template.....	92
Competency matrix (NATED/NCV mapping).....	92
How this works.....	94
Visual Basic toolkit: Export exam, draw AND truth table, and compute engineering answers.....	94
What this does.....	94
VBA code.....	94
How to use.....	98
Visual Basic toolkit: export exam, compute rectifier output, transformer voltage, and draw NAND truth table.....	99
Overview.....	99
VBA code.....	99
How to use.....	102
Visual Basic toolkit: export exam sections, compute EE answers, and draw logic truth tables.....	103
What this does.....	103

VBA code.....	103
How to use.....	108
Visual Basic toolkit: logigram, algorigram, and exam export for control, supervision, and calculus.....	112
Overview.....	112

□ **Key Points from MIL-STD-11991B**

- Scope: Defines requirements for managing parts, materials, and processes (PM&P) across development, production, and sustainment of military systems.
- Applicability: Approved for use by all DoD departments and agencies.
- COTS evaluation: Provides criteria for assessing commercial off-the-shelf items before incorporation into military systems.
- Definitions: Establishes standardized meanings for terms like *approved supplier, authenticity, counterfeit parts, component qualification, corrosion prevention and control, life cycle stages*, etc.
- Life cycle model: Explicitly breaks down introduction, growth, maturity, and decline phases for components and materials.
- Counterfeit prevention: Strong emphasis on authenticity, authorized suppliers, and certificates of conformance.
- Corrosion prevention and control (CPC): Embedded as a requirement for long-term sustainment.
- Government-Industry Data Exchange Program (GIDEP): Encourages reporting and sharing of reliability and defect data.

□ **Why this matters for your work**

Given your focus on **audit-ready documentation and competency matrices**, this standard is a goldmine:

- It provides **terminology anchors** for your checklists (e.g., “approved supplier,” “derating,” “ESD”).
- It supports **crosswalks** between technical reliability practices and psychometric indicators (e.g., “authenticity” → validity; “inspection” → reliability).
- It can be mapped into **artifact templates**: supplier qualification sheets, COTS evaluation logs, corrosion control checklists, and counterfeit detection protocols.

Would you like me to **translate these definitions into a structured checklist** (e.g., supplier approval → evidence log, COTS evaluation → decision matrix, life cycle → audit sheet), or would you prefer a **competency matrix** that ties these PM&P requirements to engineering education outcomes?

□ Overview & Scope

- **MIL-STD-11991B (3 Oct 2023)**: General standard for **Parts, Materials, and Processes (PM&P)** in military systems.
- **Scope**: Applies across design, manufacture, sustainment, and evaluation of COTS (commercial off-the-shelf) items.
- **Purpose**: Ensure reliability, authenticity, and lifecycle management of components.

□ Statement & Metadata Analysis

- **Metadata anchors**: Document version (B, superseding A), approval authority (DoD), distribution statement (A = unlimited).
- **Analysis focus**:
 - Traceability of suppliers and components.
 - Lifecycle phases (introduction → growth → maturity → decline).
 - Counterfeit prevention and authenticity checks.
- **Audit tags**: Approved supplier, certificate of conformance, corrosion prevention, ESD protection.

□ Management Information System (MIS)

Advantages

- Centralized tracking of PM&P compliance.
- Integration with GIDEP for defect reporting.
- Supports decision matrices for COTS evaluation.

Disadvantages

- Complexity in aligning multiple MIL-DTL and MIL-PRF specs.
- High overhead in maintaining supplier qualification data.
- Risk of outdated metadata if not synced with ASSIST database.

□ Investigation Principles

- **Evidence-based:** Supplier authenticity, component qualification, lifecycle documentation.
- **Collision incidence:** In systems terms, refers to conflicts between standards, duplicate parts, or mismatched specifications.
- **Resolution:** Apply order of precedence (MIL-STD > MIL-DTL > MIL-PRF).

□ Auditing with Visual Basic, Logigram, Algorigram

- **Visual Basic modules:** Automate supplier logs, defect tracking, and lifecycle curves.
- **Logigram (logic diagram):** Map decision flow for COTS acceptance.
- **Algorigram (algorithm diagram):** Represent audit routines (e.g., counterfeit detection → supplier verification → lifecycle tagging).

□ Research Methodology

- **Descriptive:** Document scope, definitions, and applicability.
- **Analytical:** Compare MIL-STD-11991B with related MIL-DTL/MIL-PRF specifications (cables, connectors, lubricants, semiconductors).
- **Experimental:** Test compliance of COTS items against reliability and corrosion standards.
- **Applied:** Build audit-ready checklists and competency matrices.

□ Integration with Related Specifications

Examples of linked specs under MIL-STD-11991B umbrella:

- **MIL-DTL-28830:** RF coaxial cables.
- **MIL-DTL-28875:** RF/microwave amplifiers.
- **MIL-PRF-19500:** Semiconductor devices.
- **MIL-PRF-38535:** Integrated circuits manufacturing.
- **MIL-STD-6012:** Corrosion protection for space flight hardware.

These form the **technical backbone** for PM&P compliance across domains (electronics, optics, lubricants, fiber optics).

Suggested Next Step

Would you like me to **design a visual logigram/algorigram** that shows how MIL-STD-11991B requirements flow into auditing routines (supplier → component → lifecycle → defect reporting), or should I **map a competency matrix** linking these standards to engineering education outcomes?

Options:

- visual logigram for auditing routines
- competency matrix linking standards to education
- expanded MIS advantages/disadvantages analysis
- detailed research methodology framework

□ Scope of MIL-STD-11991B

- Establishes **requirements for managing parts, materials, and processes (PM&P)** in military systems.
- Applies across **development, production, and sustainment** phases.
- Provides **criteria for evaluating COTS (commercial off-the-shelf) items** before incorporation into defense systems.
- Approved for use by **all DoD departments and agencies**.

□ Metadata & Document Context

- **Versioning:** Supersedes MIL-STD-11991A (2015).
- **Distribution:** Statement A (public release, unlimited distribution).
- **Custodians:** Army, Navy, Air Force, OSD, DLA.
- **Not measurement sensitive:** Focuses on management practices rather than dimensional tolerances.
- **Cross-references:** Relies on other MIL-DTL and MIL-PRF specifications (cables, semiconductors, lubricants, connectors, etc.).

□ Key Definitions (Section 3)

- **Approved supplier / Authorized supplier:** Entities vetted for authenticity and reliability.
- **Authenticity:** Assurance that parts/materials are genuine and not counterfeit.
- **Counterfeit parts:** Explicitly addressed, with requirements for detection and prevention.

- **Component obsolescence management:** Lifecycle tracking to anticipate decline and replacement.
- **Corrosion prevention and control (CPC):** Mandatory for long-term sustainment.
- **Derating:** Using components below maximum ratings to improve reliability.
- **Electrostatic discharge (ESD):** Protection requirements for sensitive electronics.
- **Disposition:** Handling of defective or obsolete items.

□ Auditing & MIS Integration

- **Management Information Systems (MIS)** can track:
 - Supplier approvals and certificates of conformance.
 - Lifecycle stages (introduction → growth → maturity → decline).
 - Defect reporting via GIDEP.
- **Advantages:** Centralized compliance, traceability, reduced counterfeit risk.
- **Disadvantages:** Complexity, overhead, risk of outdated metadata if not synced with ASSIST.

□ Research & Investigation Principles

- **Evidence-based auditing:** Supplier authenticity, lifecycle documentation, defect logs.
- **Collision incidence:** Conflicts between overlapping standards or duplicate parts.
- **Resolution:** Apply order of precedence (MIL-STD > MIL-DTL > MIL-PRF).
- **Research methods:**
 - *Descriptive:* Document definitions and scope.
 - *Analytical:* Compare across related specifications.
 - *Applied:* Build checklists, competency matrices, and audit routines.

□ Practical Tools for You

- **Visual Basic modules:** Automate supplier logs, defect tracking, lifecycle curves.
- **Logigram (logic diagram):** Map decision flow for COTS acceptance.
- **Algorigram (algorithm diagram):** Represent audit routines (e.g., counterfeit detection → supplier verification → lifecycle tagging).

□ Concluding Material

- **Custodians:** Army (MI), Navy (SH), Air Force (11), OSD (SO).
- **Review activities:** Army AV, Air Force 19/71/85, DLA CC, MDA.
- **Reminder:** Always verify current custodians and responsibilities via ASSIST Online.

Would you like me to **design a logigram/algorigram** that visually maps how MIL-STD-11991B flows into auditing routines (supplier → component → lifecycle → defect reporting), or should I **build a competency matrix** that ties these PM&P requirements to engineering education outcomes?

Options:

- **logigram for auditing routines**
- **algorigram for counterfeit detection flow**
- **competency matrix linking standards to education**
- **expanded MIS advantages/disadvantages analysis**

Data requirements overview for MIL-STD-11991B incoming inspections

Table 1: PM&P incoming inspection data requirements (Appendix H, H.2.1)

Requirement	EEE parts	Mechanical parts	Materials	Notes
Database fields maintained for life of program	Yes	Yes	Yes	Lot date code, purchase order requirements, C of C data
Documented procedures for incoming tests	Yes	Yes	Yes	Procedures must define sampling, methods, acceptance criteria
Liquid penetrant inspection	—	Yes	Yes (non-porous only)	Surface defects only
Magnetic particle inspection	—	Yes	—	Ferromagnetic materials; surface/below-surface defects
Ultrasonic inspection	—	Yes	Yes	Internal defects
Eddy current inspection	—	Yes	—	Coating thickness, conductivity, wear

Requirement	EEE parts	Mechanical parts	Materials	Notes
				(metallic only)
Radiological inspection (X-ray)	Yes (as applicable)	Yes	—	Internal defects
Destructive tests (shear, compression, cross-section, corrosion)	—	Yes	Yes	As applicable per spec and sampling plan
Certificate of Conformance (C of C)	Yes	Yes	Yes	Include FTIR, XRF, ASTM/SAE tests, hardness as relevant
External visual	Yes	Yes	—	Damage, marking, workmanship
DPA (Destructive Physical Analysis)	Categories A-B required (one per lot for specific device types)	—	—	Not a standalone counterfeit test; see MIL-STD-1580
PIND (Particle Impact Noise Detection)	Categories A-C, T	—	—	Hermeticity/loose particles
XRF (coating/material discrepancies e.g., pure tin)	Yes	—	—	Part of receiving inspection sampling
Material analysis (verify material characteristics)	Yes	Yes	Yes	Method depends on material and risk

Sources: Appendix H excerpts you provided.

Table 2: Electronic components inspection and test (Appendix F, Table F-I)

Test/Inspection	Applies to	Indicators	Comments/Notes	Difficulty
Documentation check	All parts	Spelling/grammar errors, inaccuracies, omissions	Detect fake documentation; refer to IDEA-STD-1010	Low [High]

Test/ Inspection	Applies to	Indicators	Comments/Notes	Difficulty
Bar code check	All parts	Discrepancy between barcode and human-readable	Detect fake packaging; refer to IDEA-STD-1010	Low [Med]
Visual inspection	All parts	Inconsistencies, poor quality, defects, multiple lot date codes	Detect used/refurbished/re-marked; refer to IDEA-STD-1010	Med [High]
Marking permanency (mineral spirits, alcohol)	ICs/plastic/ceramic/metal packages	Removal of ink marking	Detect remarked parts; MIL-STD-883 Method 2015	Low [High]
Surface finish permanency (acetone)	ICs/plastic/ceramic/metal packages	Removal of coating, sanding marks; ink removal not rejection cause	Detect blacktopped parts; IDEA-STD-1010	Low [High]
Surface finish permanency (heated aggressive solvent)	ICs/plastic/ceramic/metal packages	Removal of coating, sanding marks; ink removal not rejection cause	Detect blacktopped (e.g., Dyna-Solve 750)	Med [High]
X-ray fluorescence (XRF)	Tin-lead termination parts	Finishes not compliant (Pb content)	Detect retinned/remarked parts	Med [Med]
X-ray (radiological)	Components with die/leadframe	Inconsistent die size/leadframe	Detect incorrect die/wrong parts	Med [High]

Sources: Appendix F excerpts you provided.

Minimal data model for the incoming inspection database

- **Part identification:** Manufacturer, part number, description.
- **Lot data:** Lot date code, quantity received, equipment category (A/B/C/D/E/T).
- **Procurement linkage:** Purchase order number, line item, specification referenced.
- **Supplier status:** Authorized/approved supplier flag, broker/distributor type.
- **Certificates:** C of C metadata, test reports (FTIR, XRF, ASTM/SAE, hardness).
- **Inspection records:** Visual, NDT (LP, MPI, UT, EC, X-ray), DPA/PIND, XRF results.
- **Disposition:** Accept/reject, rework, quarantine, corrective action reference.
- **Traceability:** Inspector ID, procedure/version used, sampling plan, date/time.
- **Risk tags:** Counterfeit risk indicators, tin-whisker/pure-tin flags, ESD sensitivity.

Quick notes you can embed in your algorigram/logigram

- **Intake:** Receive → verify supplier authorization → check documentation → barcode.
- **Screening:** Visual → marking permanence → surface finish tests → XRF/X-ray as applicable.
- **Special tests:** DPA/PIND for Categories A-C/T per device type and sampling.
- **Material/NDT:** Apply LP/MPI/UT/EC/X-ray based on part class and material.
- **Decision:** Conform → database commit → acceptance; Non-conform → quarantine → corrective action.
- **Trace:** Attach C of C and test evidence; lock lot/date code traceability for life of program.

If you want, I can turn these tables into a fillable Visual Basic form spec and a one-page audit checklist you can slot into your portfolio.

□ Table A-VI. Microcircuit Derating Factors

Critical Stress Parameter	Digital	Linear	Notes
Maximum Supply Voltage	0.90	0.80	Do not exceed 90% (digital) or 80% (linear) of max rating

Critical Stress Parameter	Digital	Linear	Notes
Recommended Supply Voltage	±5%	±5%	Use manufacturer's recommended operating conditions
Input Voltage	0.70	0.70	Must not exceed supply voltage unless approved
Operating AC/DC Output Current or Fanout	0.80	—	Applies to digital outputs
Power Dissipation	0.80	0.75	Limit to 80% (digital), 75% (linear)
Maximum Junction Temperature	40°C below max rating	40°C below max rating	Applies across devices

□ **Table A-IV. EMI Filter Derating Factors**

Filter Type	Critical Stress Parameter	Derating Factor	Max Operating Temperature
All	Rated Current	0.75	30°C below manufacturer's max
All	Rated Voltage	0.50	30°C below manufacturer's max

□ **Table A-I. Capacitor Derating Factors**

Type	Voltage Derating Factor	Max Case Temperature
Aluminum Electrolytic	Not allowed	Not allowed
Ceramic	0.50	20°C below max rating
Glass	0.50	20°C below max rating
Plastic Film	0.50	20°C below max rating
Mica	0.50	20°C below max rating
Tantalum, Non-solid	0.50	20°C below max rating
Tantalum, Solid	0.50 (non-surge), 0.30 (surge tested)	70°C / 110°C depending on type
Variable	Not allowed	Not allowed

□ **Table A-II. Crystal Oscillator Derating Factors**

Critical Stress Parameter	Derating Factor	Max Junction Temperature
Supply Voltage	0.80	—
Operating AC/DC Output Current or Fanout	0.80	—
Maximum Junction Temperature	—	40°C below manufacturer's max

□ Table A-III. Diode Derating Factors

Diode Type	Critical Stress Parameter	Derating Factor	Max Junction Temperature
Small Signal, Rectifier, Power Schottky, Thyristors	Reverse Voltage	0.60	40°C below rating
	Forward Current	0.50	—
	Surge Current	0.50	—
	Power	0.50	—
Varactor/Varicap	Power	0.50	40°C below rating
	Reverse Voltage	0.75	—
	Forward Current	0.75	—
Voltage Regulators	Power	0.50	40°C below rating
	Zener Current	0.75	—
Voltage Reference	Power	0.50	40°C below rating
	Zener Current	1.00	—
Transient Absorption Zener/TVS	Power	0.50	40°C below rating
	Dissipation	0.50	40°C below rating
	Average Current	0.60	—
FET Current Regulator	Peak Operating Voltage	0.75	40°C below rating
RF/Microwave Diodes	Power	0.50	40°C below rating
PIN, Schottky, Gunn, Tunnel, etc.	Reverse Voltage	0.60	—
	Forward Current	0.50	—

□ Table A-VII. Optoelectronic Device Derating Factors

Device Type	Critical Stress Parameter	Derating Factor	Max Temperature
LEDs, Photodiodes, Phototransistors	Power Dissipation	0.50	30°C below max
	Forward Current	0.70	—
	Voltage	0.70	—
Laser Diodes	Power Dissipation	0.50	30°C below max
	Forward Current	0.70	—
Optocouplers	Power Dissipation	0.50	30°C below max
	Forward Current	0.70	—
	Breakdown Voltage	0.70	—
Fiber Optic Cable	Bend Radius (min)	2.00	Manufacturer's max
	Cable Tension	0.50	—
	Fiber Tension Proof	0.20	—

□ These tables are now structured for **audit-ready use**. You can embed them into:

- **Visual Basic forms** for automated derating checks.
- **Logigrams/algorigramms** showing decision flows (e.g., capacitor type → allowed/not allowed → derating factor).
- **Competency matrices** linking stress parameters to reliability practices in engineering education.

Would you like me to **design a combined logigram** that visually maps how derating factors apply across device families (microcircuits → capacitors → diodes → optoelectronics), or should I prepare a **checklist template** for incoming inspection + derating compliance?

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□ Table XXXI. Fungi Susceptibility of Materials

Group I - Fungus-inert materials	Group II - Fungus-nutrient materials
Acrylics	ABS (acrylonitrile-butadiene-styrene)
Acrylonitrile-styrene	Acetal resins
Acrylonitrile-vinyl-chloride copolymer	Cellulose acetate

Group I - Fungus-inert materials	Group II - Fungus-nutrient materials
Asbestos	Cellulose acetate butyrate
Ceramics	Epoxy-glass fiber laminates
Chlorinated polyester	Epoxy resin
FEP (fluorinated ethylenepropylene copolymer)	Lubricants
Glass	Melamine-formaldehyde
Metals	Organic polysulphides
Mica	Phenol-formaldehyde
Plastic laminates	Polydichlorostyrene
Silicone-glass fiber	Polyethylene (low/medium density ≤ 0.940)
Phenolic-nylon fiber	Polymethyl methacrylate
Diallyl phthalate	Polyurethane (ester types susceptible)
Polyacrylonitrile	Polyricinoleates
Polyamide (note: may be attacked selectively)	Polyvinyl chloride (PVC)
Polycarbonate	PVC-acetate
Polyester-glass fiber laminates	Polyvinyl fluoride
Polyethylene (HD >0.940)	Rubbers (natural/synthetic)
PET (polyethylene terephthalate)	Urea-formaldehyde
Polyimide	—
Polymonochlorotrifluoroethylene	—
Polypropylene	—
Polystyrene	—
Polysulfone	—
PTFE (polytetrafluoroethylene)	—
Polyvinylidene chloride	—
Silicone resin	—
Siloxane polymers (polyolefin, polystyrene)	—

□ **Table VII. Resistor and Thermistor Specifications**

Specification	Description
MIL-PRF-236 48	Resistor, Thermal (Thermistor) Insulated
MIL-PRF-321	Resistors, Chip, Thermal (Thermistor)

Specification	Description
92	
MIL-PRF-39005	Resistors, Fixed, Wire-Wound (accurate), Non-established & Established Reliability
MIL-PRF-39007	Resistors, Fixed, Wire-Wound (Power Type), Non-established, Established, Space Level
MIL-PRF-39009	Resistors, Fixed, Wire-Wound (Power Type, Chassis Mounted)
MIL-PRF-39015	Resistors, Variable, Wire-Wound (Lead Screw Actuated)
MIL-PRF-39017	Resistors, Fixed, Film (Insulated)
MIL-PRF-49462	Resistors, Fixed, Film, High Voltage
MIL-PRF-55182	Resistors, Fixed, Film, Non-established, Established, Space Level
MIL-PRF-55342	Resistors, Fixed, Film, Chip, Non-established, Established, Space Level
MIL-PRF-83401	Resistor Networks, Fixed Film, Capacitor-Resistor Networks

□ **Table VIII. Switch Specifications**

Reference Document	Description
MIL-DTL-3786	Switches, Rotary (Circuit Selector, Low-Current Capacity)
MIL-DTL-3928	Switches, RF Transmission Line (Coaxial)
MIL-DTL-3950	Switches, Toggle, Environmentally Sealed
MIL-DTL-6807	Switches, Rotary, Selector Power
MIL-DTL-8834	Switches, Toggle, Positive Break
MIL-DTL-9395	Switches, Pressure (Absolute, Gage, Differential)
MIL-DTL-9419	Switch, Toggle, Momentary, Four-Position On, Center Off
MIL-DTL-12211	Switch, Pressure
MIL-DTL-12285	Switch, Thermostatic
MIL-DTL-13484	Switch, Sensitive, Waterproof
MIL-DTL-13625	Switch, Pull/Push, Beam Selecting, Headlight
MIL-DTL-13735	Switches, Toggle (28 VDC)
MIL-DTL-15291	Switches, Rotary, Snap Action, Detent/Spring Return

Reference Document	Description
MIL-DTL-15743	Switches, Rotary, Enclosed
MIL-DTL-21604	Switches, Rotary, Multipole & Selectors
MIL-DTL-24317	Switches, Multistation, Pushbutton (Illuminated/Non-Illuminated)
MIL-DTL-28788	Switches, Air & Liquid Flow, Sensing
MIL-DTL-28827	Switches, Thermostatic (Volatile Liquid), Hermetically Sealed
MIL-DTL-83731	Switches, Toggle, Unsealed/Sealed
MIL-PRF-22710	Switches, Code Indicating Wheel (Thumbwheel, Pushbutton)
MIL-PRF-22885	Switches, Push Button, Illuminated
MIL-PRF-24236	Switches, Thermostatic (Metallic, Bimetallic)
MIL-PRF-83504	Switches, Dual In-line Package (DIP)
MIL-PRF-8805	Switches & Assemblies, Sensitive, Snap Action
MIL-S-16032	Switches & Detectors, Shipboard Alarm Systems
MIL-S-18396	Switches, Meter & Control, Naval Shipboard
W-S-896	Switches, Toggle (Toggle & Lock), Flush Mounted

□ **Table IX. Waveguide Reference Documents**

Item	Description	Reference Document
Amplifier	RF & microwave DIP, coaxial, TO, flatpack	MIL-DTL-28875
Attenuators	Fixed & variable coaxial/waveguide	MIL-DTL-3933
Circulators	RF-SMA & waveguide	MIL-DTL-28791
Couplers	Directional coaxial waveguide & printed circuit	MIL-DTL-15370
Coupling assemblies	Quick-disconnect for subminiature waveguide flanges	MIL-DTL-3954
Dummy loads	Waveguide, coaxial, stripline	MIL-DTL-39030
Flanges	Waveguide & coaxial	MIL-DTL-3922 / MIL-DTL-24044
Gaskets	Pressure sealing for cover flanges/flat face	MIL-DTL-24211
Isolators	RF-SMA & stripline	MIL-DTL-28791
Mixer stages	RF-DIP, flatpack, TO, connector	MIL-DTL-28837
Power dividers/combiners	Plug-in, flatpack, TO, connector	MIL-DTL-23971

Item	Description	Reference Document
Switches	Waveguide-to-waveguide manual/electro	(spec continues in MIL-STD-11991B)

□ These tables are now **normalized** for quick reference. You can embed them into:

- **Audit checklists** (fungus testing, resistor/switch qualification, waveguide compliance).
- **Competency matrices** (mapping material susceptibility, component reliability, and environmental qualification).
- **Visual Basic forms/logigrams** (decision flows for material acceptance, switch selection, waveguide assembly compliance).

Would you like me to **design a combined audit checklist template** that integrates fungus susceptibility, resistor/switch qualification, and waveguide compliance into one inspection flow?

.

□ Capacitor Styles and Application Considerations (Table extract, §5.2.2)

Capacitor Style / Dielectric	Reference Specification	Style Code	Application Considerations
Solid Tantalum (Low Impedance)	MIL-PRF-39003/10	CSS	1 Ω /volt series impedance required; surge current screen & Weibull grading required
Solid Tantalum Chip	MIL-PRF-55365	CWR	Same as above; ESR verification above 400 kHz
Wet Tantalum (CLR79, CLR81)	MIL-PRF-39006/22 & /25; DSCC Dwgs 06013/06014	CLR79, CLR81	Account for ESR change with frequency
Wet Tantalum (CLR90, CLR91)	MIL-PRF-39006/30 & /31; DSCC Dwgs 06015/06016	CLR90, CLR91	Same ESR considerations
Electrolytic, Aluminum	MIL-PRF-39018	—	Requires contracting activity approval; not for storage >1 year
Types in AEC Q200	AEC Q200	—	Additional assessment required for Categories A, B, C

Notes:

- Obsolete types not allowed for new designs.
- BME capacitors must comply with MIL-PRF-32535.
- Dielectric protection required to prevent arcing.
- Short-circuit clearing energy limit: 500 mJ for metallized film.

□ Table IV. Hermetic Microcircuit and Semiconductor Requirements

Equipment Category	Microcircuit	Semiconductor
A	MIL-PRF-38535 (Class S), MIL-PRF-38534 (Class K)	MIL-PRF-19500 (JANS)
B	MIL-PRF-38535 (Class S, B), MIL-PRF-38534 (Class K, H)	MIL-PRF-19500 (JANS, JANTXV, JANTX)
C	MIL-PRF-38535 (Class S, B), MIL-PRF-38534 (Class K, H)	MIL-PRF-19500 (JANS, JANTXV, JANTX)
D	AEC Q100, MIL-PRF-38535 (Class S, B), MIL-PRF-38534 (Class K, H)	AEC Q101 or MIL-PRF-19500 (JANS, JANTXV, JANTX)
E	AEC Q100, MIL-PRF-38535 (Class S, B), MIL-PRF-38534 (Class K, H)	AEC Q101 or MIL-PRF-19500 (JANS, JANTXV, JANTX, JAN)
T	AEC Q100, MIL-PRF-38535, MIL-PRF-38534 (application-dependent)	AEC Q101 or MIL-PRF-19500 (application-dependent)

□ Table V. Plastic Encapsulated Microcircuit and Semiconductor Requirements

Equipment Category	Microcircuit	Semiconductor
A	PEM-INST-001	PEM-INST-001
B	JESD47 with sequential environments	JESD47 with sequential environments
C	AEC Q100, MIL-PRF-38535 (Class N), MIL-PRF-38534	AEC Q101
D	AEC Q100, MIL-PRF-38535 (Class N), MIL-PRF-38534	AEC Q101
E	AEC Q100, MIL-PRF-38535 (Class N), MIL-PRF-38534	AEC Q101

Equipment Category	Microcircuit	Semiconductor
T	AEC Q100, MIL-PRF-38535, MIL-PRF-38534 (application-dependent)	AEC Q101 (application-dependent)

Notes:

- PEMs must be moisture sensitivity classified per J-STD-020.
- Handling per J-STD-033.
- PEMs with MSL >4 not approved; MSL <3 required for wave solder exposure.
- Sequential environments = preconditioning + 2 cycles of humidity/temperature stress + temp cycling.

□ EMI & RFI Filters (Section 5.2.6)

Filter Type	Reference Specification	Assurance Level
Low-pass EMI/RFI filters	MIL-PRF-28861 (Class S, Class B)	Class S = highest assurance, space applications
Suppression capacitors	MIL-PRF-15733	General requirements
General filters	AEC Q200	Commercial qualification standard

□ These tables are now structured for **audit-ready integration**. You can embed them into:

- **Inspection checklists** (capacitor ESR verification, PEM moisture sensitivity, hermetic device class compliance).
- **Competency matrices** (mapping device categories to reliability standards).
- **Visual Basic logigrams** (decision flows: capacitor style → spec compliance → application approval).

Would you like me to **combine these capacitor + microcircuit + filter tables into a single audit checklist template** that inspectors can use step-by-step, or keep them as separate reference tables for modular use?

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□ Table 1. Documented Procedures & Quality System Requirements (Section 4.3)

Clause	Requirement	Reference Standards
4.3.7 Quality System	Manufacturers/distributors must have documented QMS validated by trained auditors; must meet ISO 9000 / SAE AS9100 or equivalent	JEDEC JESD74, ANSI/VITA 51.2-2011, JEDEC JEP122, JEDEC JEP70
4.3.8 Process Management	Documented processes must identify qualification methods and demonstrate repeatability of part specs	ISO 9000, SAE AS9100
4.3.9 Compatibility	Ensure parts/materials are compatible with assembly/manufacturing processes, including repair/rework	Internal documented procedures
4.3.10 Maintainability/Testability	Ensure maintainability/testability consistent with application requirements	Internal documented procedures
4.3.11 Prohibited PM&P	Ensure prohibited parts/materials/processes (Appendix C) are not used without approval	Appendix C

□ Table 2. Life Cycle Management Requirements (Section 4.4)

Clause	Requirement	Notes
4.4.1 Procurement	Ensure procurement meets allocated system requirements	Controlled supplier approval
4.4.2 Counterfeit Prevention	Avoid counterfeit parts; control potential counterfeit to not impact performance	Appendix F requirements
4.4.3 Continuous Monitoring	Manufacturing must follow documented processes ensuring reliability, quality, and equivalence	Root cause analysis for trends
4.4.4 Non-Conforming Parts	Non-conforming materials cannot be installed/fielded without approval	Quarantine & corrective action
4.4.5 Change Monitoring	Detect, track, monitor, notify supplier changes; assess impact on system performance	Change control procedures
4.4.6 Obsolescence	Proactive management per SAE STD-0016; see Appendix G	Lifecycle planning

Clause	Requirement	Notes
4.4.7 Design/Use Data	Collect, store, analyze, report all relevant PM&P data; prevent re-installation of removed parts	Traceability enforced
4.4.8 Data Retention	Retain attribute data, inspection/test data, DPA samples, traceability records per procuring activity	Long-term archival
4.4.9 Configuration Management	Maintain hardware configuration with controlled PM&P list and documentation of changes	Integrated CM system
4.4.10 Reuse of Parts	Removed parts/materials cannot be reused without approval	Strict reuse control
4.4.11 Supply Chain Risk	Assess and mitigate supply chain risks (threats, vulnerabilities, disruptions)	Risk management framework
4.4.12 System Security	Identify, assess, address cybersecurity risks to PM&P	Hardware/software assurance

□ Table 3. COTS & Subcontractor Management (Sections 4.5-4.6)

Clause	Requirement	Reference
4.5 COTS Management	Establish/maintain COTS management approach per EIA-933; comply with Appendix B (COTS) & Appendix C (Prohibited PM&P)	EIA-933
4.6 Subcontractor Management	Flow down requirements to lowest tier; verify compliance	Supplier audits

□ Table 4. Parts Requirements (Section 5.2)

Part Type	Requirement	Reference Standards
Printed Wiring Boards (PWBs)	Design per IPC-2220 Series Class 3; fabricate per IPC-6010 Series Class 3/3A; suppliers should meet IPC-1791	IPC-2220, IPC-6010, IPC-1791
Capacitors	Must meet applicable reference specification; address application considerations in design reviews/change proposals	MIL-HDBK-198, MIL-PRF specs

□ These tables now give you a **clear, audit-ready framework**. You can embed them into:

- **Quality system checklists** (ISO/AS compliance, counterfeit prevention, obsolescence).
- **Lifecycle management matrices** (procurement → monitoring → obsolescence → data retention).
- **Visual Basic logigrams** (decision flows for supplier approval, counterfeit detection, reuse control).

Would you like me to **design a unified audit checklist template** that integrates these documented procedure requirements into a step-by-step inspection flow, or keep them modular for separate use in your competency matrices?

□ **Table I. Equipment Categories and Definitions**

Category	Definition
A	Continuous use systems. Non-repairable systems under space environment conditions (e.g., satellites). Must meet radiation hardness requirements (low dose rate, high total dose).
B	Impulse (single-shot) systems. Equipment exposed to extreme launch/trajectory/return conditions. Non-repairable once deployed. Radiation hardness requirements (possible high dose rate, low total dose).
C	Aircraft systems. Equipment exposed to turbulence, air temperature/pressure fluctuations, vibration.
D	Ground and sea-based mobile systems. Repairable systems exposed to temperature/humidity fluctuations, vibration, shock, electromagnetic environmental effects.
E	Stationary ground systems. Repairable systems in controlled environments, readily accessible to maintenance, typically in constant use.
T	Targets. Test-specific, non-deployable systems, sometimes exposed to extreme launch/trajectory/return conditions.

□ **Table II. Life Cycle Stresses**

Stress	Application Consideration	Guidance Standards
Temperature limits	Usage outside manufacturer's specified limits discouraged;	IEC TR 62240-1, GEIA-STD-0008, RTCA

Stress	Application Consideration	Guidance Standards
	damage occurs if exceeded during manufacturing, operation, storage, transport.	DO-160, JESD22-A103, JESD22-A108, JESD22-A119
Temperature variations	Long-term cycling can cause damage due to mismatched coefficients of thermal expansion (CTE).	JESD22-A104
Heat dissipation & cooling	Proper cooling required to prevent damage; must verify thermal/electrical stress analysis against manufacturer's ratings.	JEP149
Mechanical shock	Stress limits exceeded during shock; production variations or temperature cycling increase susceptibility.	MIL-STD-810
Mechanical vibration	Long-term vibration exposure can cause damage; susceptibility increased by production variations or temperature cycling.	MIL-STD-810
Natural radiation	Cosmic rays, neutrons, heavy ions may cause Single Event Effects (SEE).	IEC 62396 series, JESD89
Induced radiation	Damage from nuclear radiation or X-ray inspection.	—
Moisture & corrosion	Damage from moist/corrosive environments, especially at elevated temperatures.	JESD22-A100, JESD22-A120, J-STD-020
Electromagnetic capability	Assemblies may produce EMI or be susceptible to interference.	IEC 61967 series
Electrostatic discharge (ESD)	Handling can induce ESD damage.	ESD-S20.20, JESD625
Other stresses	As applicable from system use environment or customer specifications.	—

□ These tables now give you a **clear framework** for:

- **Audit checklists** (e.g., verifying equipment category assignment, stress compliance).
- **Competency matrices** (mapping environmental stresses to engineering practices).

- **Visual Basic logigrams** (decision flows: category → stress → mitigation → compliance).

Would you like me to **design a combined audit checklist template** that integrates both equipment category assignment and life cycle stress verification into a single inspection flow?

□ Key Definitions from MIL-STD-11991B (Section 3)

Term	Definition	Notes / Application
Approved supplier	Formally assessed supplier with adequate procedures for providing parts/materials, including counterfeit avoidance, detection, containment, and reporting.	Approval process is part of risk management.
Authenticity	Process of inspections/tests to determine if a part/material has been misrepresented (counterfeit). Passing authenticity checks = likely valid version of intended item.	Supports counterfeit detection protocols.
Authorized supplier	Supplier authorized by the original component manufacturer (OCM) to buy parts directly. Parts remain in authorized supply chain with full manufacturer support/warranty. Also called franchise supplier/distributor.	Preferred source for procurement.
Broker	Unauthorized supplier, typically independent distributor, buying/selling parts without stock or OCM authorization.	Higher counterfeit risk.
Certificate of Conformance (C of C)	Document declaring furnished supplies/services meet contract requirements.	Critical for traceability and audit.
COTS item	Commercially Available Off-the-Shelf item: sold in substantial quantities in marketplace, offered to government without modification. Excludes bulk cargo (e.g., petroleum, agricultural).	Must be evaluated for suitability before use.
Component	Used interchangeably with "part." Includes subsystems, assemblies, subassemblies, major elements of end item. Excludes items of small annual acquisition value.	Scope broadens beyond piece parts.
Component	Management actions to avoid/resolve	Requires

Term	Definition	Notes / Application
obsolescence management	effects of discontinued components. Considered part of risk management.	proactive monitoring.
Component qualification	Demonstration that a component meets application specifications under required conditions/environments.	Supports reliability assurance.
Component quality assurance	Activities/processes ensuring confidence that each component meets performance/environmental requirements.	QA framework.
Component selection	Choosing a specific component for a specific application.	Must align with system requirements.
Component standardization	Consensus process to establish uniform engineering criteria for compatibility, interoperability, interchangeability, or commonality. Reduces proliferation of parts.	Supports logistics efficiency.
Configuration item	Aggregation of hardware, firmware, software, or portions thereof designated for separate configuration management. Ranges from large systems to piece parts.	Key for logistics support and CM.
Contracting activity	Agency element with delegated contracting authority (synonymous with procuring activity).	Defines acquisition responsibility.
Contracting officer	Person authorized to enter, administer, terminate contracts, make determinations/findings. Includes authorized representatives.	Legal authority for contracts.
Contractor	Company retained under contract to develop/produce hardware/equipment or related activities at any tier.	Applies across supply chain.
Corrosion prevention and control (CPC)	Application of engineering design, QA, NDI, manufacturing, operation/support technologies to prevent corrosion, avoid impairment, and define tracking/repair processes.	Essential for lifecycle sustainment.
Counterfeit parts/materials	Unlawful/unauthorized reproduction, substitution, or alteration misrepresented as authentic. Includes used parts sold as new, false identification, incorrect internal construction, or items not completing OCM's production/test flow.	Defined per DFARS 202.101.

□ This table now gives you a **clear, audit-ready glossary**. You can embed it into:

- **Supplier qualification checklists** (approved vs. authorized vs. broker).
- **Counterfeit detection routines** (authenticity, C of C, OCM flow compliance).
- **Lifecycle management matrices** (obsolescence, corrosion prevention, configuration items).

Would you like me to **expand this glossary into a competency matrix** that ties each definition to engineering education outcomes (e.g., QA → reliability, CPC → maintenance engineering, obsolescence → risk management), or keep it as a standalone definitions table?

:

□ General Drawing Practices

Standard	Focus	Notes
MIL-STD-100	Core standard for engineering drawing practices (formats, line conventions, dimensioning, symbols).	Works closely with ASME Y14 series (e.g., Y14.100M).
DOD-D-1000 / MIL-DTL-31000	Requirements for engineering drawings and associated lists.	Emphasizes modern digital drawing/data delivery.
MIL-STD-12	Standard abbreviations for drawings and technical documents.	Largely superseded by ASME Y14.38M.

✂ Electrical & Electronic Specific Standards

Standard	Focus	Notes
MIL-STD-1323 1	Uniform marking requirements for electronic items.	Ensures consistency in identification.
MIL-STD-1686	Electrostatic discharge (ESD) control programs.	Superseded by ANSI/ESD S20.20.
MIL-HDBK-10 04/1	Preliminary electric power design for military facilities.	Handbook guidance.
MIL-STD-461	Control of electromagnetic interference (EMI).	Critical for subsystem/equipment design.

Standard	Focus	Notes
MIL-STD-810	Environmental engineering tests (shock, vibration, temperature extremes).	Not a drawing standard, but impacts design documentation.

□ Key Non-Government Standards (Adopted by DoD)

Standard	Focus	Notes
ASME Y14.100M	Preferred requirements for engineering drawing practices.	Often supersedes MIL-STD-100.
IEEE 315 / IEC 60617	Graphic symbols for electrical/electronic diagrams.	Widely adopted internationally.

□ Related Standards You Mentioned

- **MIL-STD-11991B (2023)**: General standard for parts, materials, and processes (PM&P) in military systems.
- **MIL-STD-1285C**: Uniform marking requirements for electrical/electronic parts.
- **DoD Design Criteria Standards (DTIC)**: Practices for drawing preparation, CAD formats, titles, numbering.

□ Why These Standards Matter

- **Consistency**: Ensures drawings and documentation are uniform across DoD projects.
- **Interoperability**: Aligns military practices with commercial/industry standards (ASME, IEEE, IEC).
- **Reliability**: Supports electrical/electronic systems in demanding military environments.
- **Audit readiness**: Provides traceable, standardized documentation for procurement, sustainment, and compliance.

Would you like me to **map these standards into a competency matrix** (e.g., MIL-STD-100 → drafting skills, MIL-STD-461 → EMI design skills, MIL-STD-810 → environmental testing skills) so they can be tied directly to electrical engineering trade training outcomes?

□ Purpose & Scope

- **Purpose**: Establishes procedures for developing and maintaining UFC and UFGS.

- **Applicability:** Used by the Army, Navy, Marine Corps, Air Force, DoD defense agencies, and field activities.
- **Coverage:** Applies to planning, design, construction, operation, maintenance, sustainment, restoration, and modernization of DoD facilities.
- **Sustainability:** Explicitly integrates sustainable design and development, including project rating/scoring systems (e.g., LEED).

□ Key Sections (from the contents)

Section	Focus
Foreword	Approval and applicability across DoD branches.
1. Scope	Purpose, applicability, authority, existing criteria.
2. Applicable Documents	Government and other references; order of precedence.
3. Definitions	Discipline Working Group (DWG), Technical Proponent, Technical Representative.
4. General Requirements	Background, approach, programming/scheduling, criteria development, metrics, format standards, availability.
5. Detailed Requirements	Management procedures for UFC and UFGS, including issuance, approval, validation, waivers, exemptions, records maintenance, databases, reporting, changes, automated updates, and feedback.
6. Notes	Compliance documents and subject term listing.
Appendices A & B	Supplemental guidance.

□ Core Concepts

- **UFC (Unified Facilities Criteria):** Governs facility planning, design, construction, and sustainment.
- **UFGS (Unified Facilities Guide Specifications):** Provides standardized specifications for construction and maintenance projects.
- **Management Procedures:**
 - Draft review and comment periods.
 - Approval controls and final submittals.
 - Validation and feedback loops.
 - Waivers/exemptions process.
- **Configuration & Records:** UFC/UFGS must be maintained in master databases and indexes, with automated updates to reference publications.

- **Subcontractor Flow-down:** Requirements must cascade to all tiers of suppliers/contractors.

□ Why It Matters

- Ensures **uniformity** across DoD facility projects.
- Provides a **controlled baseline** for specifications and criteria.
- Supports **sustainability and modernization** goals.
- Reduces duplication and ensures **interoperability** across services.
- Establishes **audit-ready processes** for approvals, waivers, and updates.

Would you like me to **map MIL-STD-3007F into a visual logigram** showing the flow of UFC/UFGS management (draft → review → approval → validation → update), or prepare a **checklist template** for compliance auditing against this standard?

□ Method 105C — Barometric Pressure (Reduced Pressure Test)

Test Condition	Pressure (in Hg)	Pressure (mm Hg)	Altitude (ft)	Altitude (m)
A	8.88	226	30,000	9,144
B	3.44	87	50,000	15,240
C	1.31	33	70,000	21,336
D	0.315	8	100,000	30,480
E	0.043	1.09	150,000	45,720
F	17.3	439	15,000	4,572
G	9.436×10^{-8}	2.40×10^{-6}	656,000	200,000

Summary requirements:

- Mount specimen in sealed chamber with vacuum pump.
- Reduce pressure to specified condition.
- Allow entrapped air to escape.
- Perform specified tests during and after reduced pressure exposure.
- Specify mounting, condition letter, test type, exposure time in individual spec.

□ Method 106G — Moisture Resistance

Purpose: Accelerated evaluation of resistance to high humidity and heat typical of tropical environments.

- Effects: corrosion, distortion, decomposition of insulating materials.
- Procedure: expose specimens to cycles of high humidity/temperature per defined conditions.

□ Method 107G — Thermal Shock

Table 107-I. Thermal Shock (Air)

Step	Temp Profile (°C)	Cycles
A	-55 → +25 → +85 → +25	5, 25, 50, 100
B	-65 → +25 → +125 → +25	5, 25, 50, 100
C	-65 → +25 → +200 → +25	5, 25, 50, 100
D	-65 → +25 → +350 → +25	5, 25, 50, 100
E	-65 → +25 → +500 → +25	5, 25, 50, 100
F	-65 → +25 → +150 → +25	5, 25, 50, 100

Exposure times (Table 107-II):

- ≤28 g: 15 min (¼ hr)
- 28-136 g: ½ hr
- 136 g-1.36 kg: 1 hr
- 1.36-13.6 kg: 2 hr
- 13.6-136 kg: 4 hr
- 136 kg: 8 hr

Table 107-III. Thermal Shock (Liquid)

Step	Temp Profile (°C)	Cycles
AA	0 → 100	5, 15, 25
BB	-65 → +125	5, 15, 25
CC	-65 → +150	5, 15,

Step	Temp Profile (°C)	Cycles
DD	-65 → +200	25 5, 15, 25

Transfer time: <10 seconds between baths.

Table 107-IV. Suggested Thermal Fluids

Condition	Step 1 Fluid	Step 2 Fluid
AA	FC40 / Water	FC40 / Water
BB	FC77 / D02	FC70 / UCON-WS
CC	FC77 / D02	FC70 / UCON-WS
DD	FC77 / D02	FC70 / UCON-WS

Notes:

- Ethylene glycol not permitted.
- Tap water acceptable if chemically suitable.
- Water/alcohol mix allowed to prevent freezing.
- Fluids include 3M (FC77, FC70, FC40), Union Carbide (UCON-WS), Ausimont (D02, D03, D05, LS/215, LS/230).

☐ Method 202D (Canceled, replaced by Method 213)

Test Condition	Peak Acceleration (g)	Waveform
A	15 g	Sawtooth
B	30 g	Sawtooth
C	50 g	Sawtooth
K	30 g	Sawtooth

Test Condition	Peak Acceleration (g)	Waveform
H	75 g	h Sawtooth
I	100 g	h Sawtooth

Note: Method 202D was canceled; when specified, use **Method 213**.

□ **Method 203C – Random Drop Test**

Section	Requirement
Purpose	Simulates random, repeated impacts from handling, shipping, field service. Accelerated test to reveal structural/mechanical weaknesses not detected in shock/vibration tests.
Apparatus	Random-drop machine with 2 or 4 steel cages rotating about a common axis. Specimens mounted in steel sleeves (per Fig. 203-4).
Procedure	Specimens rigidly mounted in sleeve (no end caps). One sleeve per cage. Test duration: 45 minutes at 4–6 RPM. Rotation per Fig. 203-3.
Measurements	Taken after test per individual specification.
Summary details to specify	a. Mounting method, b. Measurements after test, c. Any adapters used.

□ **Method 204D – High-Frequency Vibration Test**

Section	Requirement
Purpose	Determines effect of vibration in ranges: 10–500 Hz, 10–2000 Hz, or 10–3000 Hz. Relevant for aircraft, missiles, tanks.
Test Conditions	A–H, chosen based on frequency range and vibration amplitude per application.
Mounting	Specimens mounted as specified. For bracketed specimens, one vibration direction

□ **Standard Mounting Fixtures (Figure 207-4A / 4B)**

Item	Description	Material	Quantity (per mounting)
1	Panel	Steel	1
2	Standard channel, 3 × 5 lb	Steel	2
3	Fabricated spacer	Steel	1
4	Spacer stiffener	Steel	4
5	Hex head bolt, .750-10UNC-2A × 1.75 in	Steel	1
6	Hex head nut, .750-10UNC-2B	Steel	1
7	Washer, 2.00 OD × .81 ID	Steel	12
8	Washer, 1.38 OD × .81 ID	Steel	12
9	Hex head bolt, .500-13UNC-2A × 1.00 in	Steel	12
10	Hex head nut, .500-13UNC-2B	Steel	4
11	Washer, 1.38 OD × .56 ID	Steel	4
12	Hex head bolt, .750-10UNC-2A × 2.50 in	Steel	4
13	Block, 2.25 × 2.00 × 1.25	Steel	4
14	Spacer block / strap (varies)	Steel	4

Notes:

- Two specimens may be mounted if separation ≥ 3 in (76.2 mm).
- Counterbalance required if only one specimen is tested.
- Reinforcement required if specimen > 20 lb.
- Clearance ≥ 1 in (25.4 mm) must be maintained.

□ **Controller Parts Mounting (Figure 207-5)**

Item	Description	Material	Quantity
1	Car building channel, 4 × 13.8 lb	Steel	1
2	Car building channel, 4 × 13.8 lb	Steel	1
3	Auxiliary mounting plate, .50 × 27 × 34 in	Steel	1
4	Spacer (per Table I)	Steel	8
5	Plastic mounting panel	Laminated plastic (MIL-I-24768/14)	8
6	Hex head bolt, .750-10UNC-2A × 7.00 in	Steel (heat-treated)	16
7	Hex head nut, .750-10UNC-2B	Steel	8
8	Washer, 2.00 OD × .18 ID	Steel	8
9	Pipe spacer, 1.00 std × 1.94 in	Steel	8

Panel sizes (Table II):

- Range from 9 × 12 in to 36 × 34 in.
- Bolt sizes vary: .500-13UNC-2A to .625-11UNC-2A.
- Bolt quantities: 4-8 depending on panel size.

□ Deck/Platform Mounted Parts (Figure 207-6)

Item	Description	Material	Quantity (for 3 mountings)
1	Car building channel, 4 × 13.8 lb	Steel	1
2	Car building channel, 4 × 13.8 lb	Steel	1
3	Auxiliary mounting plate, .38 in	Steel	1
4	Horizontal mounting plate, .50 in	Steel	1
5	Hex head bolt, .750-10UNC-2A × 7.00 in	Steel (heat-treated)	6
6	Hex head nut, .750-10UNC-2B	Steel	6
7	Washer, 2.00 OD × .18 ID	Steel	12
8	Pipe spacer, 1.00 std × 2.81 in	Steel	6
9-11	Gusset plates, .38 in	Steel	2 each
12-13	Horizontal mounting plates, .50 in	Steel	1 each
14	Stiffener, .38 in	Steel	4
15-16	Auxiliary mounting plates, .38 in	Steel	1 each

Notes:

- Select smallest platform that accommodates specimen.
- Reinforce gussets if specimen depth interferes.
- Tolerance: ±.06 in (1.52 mm).

□ Why This Matters

- These fixture designs ensure **repeatability** in vibration/shock testing.
- Provides **traceable mounting dimensions** for electrical meters, controllers, and platform parts.
- Supports **audit-ready documentation** for MIL-STD-202G compliance.

Would you like me to **design a consolidated audit checklist** that inspectors can use to verify mounting fixture compliance (panel size, bolt type, clearance, weight limits), or keep these as separate reference tables for modular use?

□ **Standardization Document Improvement Proposal (DD Form 1426)**

Purpose of the form

- Provides a structured way for engineers, contractors, or users to recommend changes to DoD standards.
- Ensures traceability: preparing activity must reply within 30 days.
- Cannot be used to request copies, waivers, or contract clarifications.

Key blocks

- **Blocks 1-3, 8:** Completed by the preparing activity (document number, date, title, activity info).
- **Blocks 4-7:** Completed by the submitter (nature of change, reason, name, organization, contact info, date).
- **Reply process:** Preparing activity responds; escalation to Defense Standardization Program Office if no reply within 45 days.

□ **MIL-STD-202G, Method 310 — Contact Chatter Monitoring**

Purpose

- Detects unwanted momentary opening/closing of electrical contacts (relays, switches, circuit breakers) under vibration, shock, or acceleration.
- Ensures contacts remain stable for longer than a specified time duration.

Test Circuits

- **Circuit A (Thyratron circuit)**
 - Monitors normally-closed or normally-open contacts.
 - Fires thyratron if contact opening exceeds specified duration.
 - Not suitable for low-level/dry-circuit ratings (<10 mA, <2 V, <10 μ s).
- **Circuit B (Preferred)**
 - Limits current to ≤ 20 mA and open-circuit voltage to ≤ 2 V.

- o Prevents arcing and carbon deposits.
- o Not suitable for openings/closings <10 μ s.

Calibration (Circuit A)

- Uses oscilloscope and calibration circuit (Figure 310-2).
- Adjust R7 to set detection time.
- Lamp DS1 indicates chatter event; remains on until reset.

□ How the Proposal and Method Tie Together

- **Improvement proposals** (DD Form 1426) are the mechanism to suggest updates to test methods like Method 310.
- Example changes might include:
 - o Updating test circuit technology (e.g., replacing thyatron with solid-state detection).
 - o Revising current/voltage thresholds to align with modern low-power electronics.
 - o Adding digital data logging requirements for chatter events.
- **Reason for recommendation:** Could be improved accuracy, reduced risk of contact damage, or alignment with newer JEDEC/IEC standards.

□ This gives you both the **administrative process (DD Form 1426)** and the **technical content (Method 310)** in one view. You can now draft a proposal that cites the specific paragraph (e.g., “3.1 Test-circuit A”) and explains why a modernized approach is needed.

Would you like me to **draft a sample filled-in DD Form 1426** showing how you might propose an update to Method 310 (e.g., replacing thyatron circuits with solid-state monitoring)?

□ Method 308 — Resistor Noise Measurement

Purpose

- Measures the RMS value of current-noise voltage generated in resistors.
- Expressed as “microvolts-per-volt-in-a-decade” index.

Calibration Technique

- Apply 1,000 Hz sine-wave across a 1 Ω series resistor.

- Adjust amplifier gain via attenuator until output meter deflects to “calibrate” line.
- Produces 60 dB reading when properly calibrated (0 dB = 1 μ V/decade).

Procedure

1. **Calibration** (standardize gain of AC system).
2. **Measure system noise** (baseline).
3. **Measure DC voltage + total noise** simultaneously.

Operating Conditions

- Ambient temperature: 25 °C $\pm$ 2 °C.
- Leads must be clean; no special prep required.
- Isolation resistor (Rm) and DC voltage (V) values not critical, but must be recorded.
- Ratings of resistor under test must not be exceeded.

Table 308-1. Standard Operating Conditions (excerpt)

Resistor under test (Rt)	Isolation resistor (Rm)	DC voltage (V)	DC power (mW)
100 Ω	1,000 Ω	3.2 V	100
120 Ω	1,000 Ω	3.8 V	120
150 Ω	1,000 Ω	4.7 V	150
180 Ω	1,000 Ω	5.7 V	180
220 Ω	1,000 Ω	7.0 V	220

□ Method 217A — Particle Impact Noise Detection (PIND)

Purpose

- Detects free-moving particulate contaminants inside sealed cavity devices (e.g., relays).
- Can be used before final sealing to eliminate loose particles.

Apparatus

- Vibration power source (oscillator + amplifier).
- Ultrasonic transducer (36–44 kHz response) + preamp.
- Vibration shaker(s).
- Oscilloscope ($\geq$ 100 kHz bandwidth).

- Audio speaker/headset.
- Test fixture to isolate transducer from external noise.
- Holding fixture for specimen.
- Shock test fixture.
- Calibration unit (solder ball container).
- Random vibration generator.

Calibration

- Performed:
 - Each time equipment is turned on.
 - Each operator change.
 - At start and end of each group test.
 - Every 4 hours during testing.
- Use container with 0.005" solder ball to verify sensitivity.
- Compare with empty container to confirm particle detection.

Test Setup

- Oscillator: 27 ± 1 Hz.
- Amplifier: 3-5 g acceleration (0.07-0.14" displacement).
- Background noise: ≤ 20 mV; must not increase > 3 dB when shaker operates.
- Oscilloscope trace: < 4 divisions displacement; reversal noise centered.
- Calibration unit must produce ≥ 40 mV random spikes.

Test Procedure

- **Degaussing:** Required for non-magnetized devices.
- **Lead protection:** Prevent long/flexible leads from striking fixture or each other.
- **Testing:**
 - Mount specimen flat against transducer.
 - Energize shaker.
 - Monitor oscilloscope + audio for non-periodic spikes.
 - A single burst of particle noise = rejection.
 - Units rejected for particle noise cannot be reworked/retested for acceptance.
 - Units rejected for mechanism noise may be retested after eliminating mechanism noise.

□ Why These Methods Matter

- **Method 308:** Ensures resistors meet noise performance requirements critical for precision electronics.
- **Method 217A (PIND):** Prevents latent failures caused by loose particles in sealed devices, ensuring reliability in vibration/shock environments.

□ **Method 214A — Random Vibration Test (Overview)**

Purpose

- To determine the ability of components to withstand random vibration environments.
- Applies to relays, switches, semiconductors, connectors, and other electrical/electronic parts.

Key Requirements

- **Monitoring:** If required, details of monitoring circuit and connection points must be specified in the individual specification.
- **Vibration Input:**
 - Measured at mounting points or as close as practical.
 - Minimum input vibration must correspond to specified test curve.
 - For massive items/multiple exciters, average of three or more inputs may be used.
 - Transverse accelerations limited to 100% of applied vibration.
- **Mounting:** Specimens mounted per individual specification; orientation and fixtures must be detailed for reproducibility.
- **Procedure:**
 - Operate vibration machine to deliver frequencies/intensities per curves (Condition I or II).
 - Apply vibration in three mutually perpendicular directions.
 - Durations: 3 min, 15 min, 1.5 hr, or 8 hr.
- **Measurements:** Conducted before, during, and after test.
- **Summary Details to Specify:**
 - Monitoring instrumentation.
 - Number/location of test points.
 - Mounting method/orientation.
 - Test condition (I or II), letter (A-K), duration.
 - Order of vibration directions.
 - Measurement requirements.

□ Table 214-I. Test Condition I (Random Vibration)

Test Condition Letter	Power Spectral Density (g ² /Hz)	Overall RMS G
A	0.02	5.35
B	0.04	7.56
C	0.06	9.26
D	0.10	11.95
E	0.20	16.91
F	0.30	20.71
G	0.40	23.91
H	0.60	29.28
J	1.00	37.80
K	1.50	46.30

(Duration of test per Section 4: 3 min, 15 min, 1.5 hr, or 8 hr, as specified.)

□ Table 214-II. Test Condition II (Random Vibration)

(Values are defined in Figure 214-2 and Table 214-II; similar structure to Table 214-I but with different spectral density envelopes for harsher vibration environments.)

□ Why This Matters

- Ensures **components can survive operational vibration environments** (aircraft, ground vehicles, space systems).
- Provides **standardized test curves** so results are comparable across suppliers and programs.
- Supports **audit-ready documentation**: mounting, monitoring, test points, and measurement procedures must be explicitly defined in the individual specification.

Would you like me to **expand Table 214-II with its specific values** (Condition II vibration envelopes), so you have both sets of test curves side-by-side for direct comparison?

.

□ Method 211A — Terminal Strength Test (Overview)

Purpose

- Ensures terminals and their attachments withstand mechanical stresses during installation/disassembly.
- Detects poor workmanship, faulty designs, or inadequate attachment methods.
- Stresses applied: axial/radial pulls, bends, twists, torsion, torque.
- Damage may appear later in environmental tests (seal, moisture, life).

□ Test Conditions

Condition	Name	Applicable Terminals	Stress Type
A	Pull (Tensile) Test	Most types	Axial tension force
B	Flat-Terminal Bend Test	Flexible flat-strip/tab leads	Bend cycle (finger pressure or fixture)
C	Wire-Lead Bend Test	Solid wire leads of limited ductility (e.g., nickel alloy, hermetic seals)	Lead fatigue/flexibility
D	Twist (Torsion) Test	Ductile solid wire leads (wraparound connections)	360° torsion rotations
E	Torque Test	Rigid threaded or insert terminals	Clockwise/ counterclockwise torque

□ Procedures

Condition A — Pull Test

- **Force applied:** 0.5, 1, 2, 3, 5, 10, or 20 lb (per spec).
- **Direction:** Along axis of termination.
- **Duration:** Gradually applied, held for 5-10 seconds.

Condition B — Flat-Terminal Bend Test

- **Cycle:** 45° bend → 90° opposite bend → return to normal (3 bends).
- **Rate:** ~3 sec per bend.
- **Operations:** 2 or 5 cycles (per spec).

Condition C — Wire-Lead Bend Test

- **Load:** 0.25, 0.5, 1, 5, or 10 lb (closest to half pull-test load).
- **Cycle:** Bend 90° → return to normal (one bend).
- **Operations:** 3 bends, same direction.
- **Restriction:** Bend starts $3/32 \pm 1/32$ in from body.

Condition D — Twist Test

- **Prep:** Lead bent 90° at $1/4$ in from body; clamped $3/64 \pm 1/64$ in from bend.
- **Cycle:** Rotate 360° alternating directions.
- **Operations:** 3 rotations (1080° total).
- **Rate:** ~5 sec per rotation.

Condition E — Torque Test

- **Direction:** Clockwise then counterclockwise.
- **Duration:** 5-15 sec.
- **Screw-thread terminals** (torque in lb-in):
 - No. 4 → 3.0
 - No. 6 → 5.0
 - No. 8 → 11.0
 - No. 10 → 15.0
 - No. 12 → 24.0
 - $1/4$ in → 32.0
- **Other rigid terminals** (torque in oz-in, based on equivalent diameter):
 - $\leq 1/16$ in → 0
 - $1/16$ - $1/8$ in → 8
 - $1/8$ - $3/16$ in → 18
 - $3/16$ - $5/16$ in → 40
 - $5/16$ - $1/2$ in → 80
 - $1/2$ in → As specified in individual spec.

□ Measurements

- Conducted **before and after test**.
- Look for:
 - Mechanical distortion.
 - Seal breakage.
 - Cracking of surrounding materials.
 - Electrical changes (shorts, opens, resistance shifts).

□ Why This Matters

- Ensures **terminal integrity** under real installation stresses.
- Prevents latent failures in subsequent environmental testing.
- Provides **standardized mechanical stress levels** for different terminal types.
- Supports **audit-ready compliance** with MIL-STD-202G.

Would you like me to **design a consolidated checklist template** (covering pull, bend, twist, and torque tests) that inspectors can use step-by-step when performing Method 211A, or keep these procedures as separate reference modules?

NIJ Body Armor Standard — Key Sections

1. Purpose and Scope

- Defines the objectives of the standard: ensuring ballistic protection for law enforcement and military personnel.
- Establishes test protocols for both **flexible armor (vests)** and **hard armor (plates/inserts)**.

2. NIJ Body Armor Classification

Type	Threats Tested Against	Notes
IIA	9 mm, .40 S&W	Lowest handgun protection.
II	9 mm, .357 Magnum	Higher handgun protection.
IIIA	.357 SIG, .44 Magnum	Highest handgun protection.
III	Rifles (non-armor piercing)	Rifle protection.
IV	Armor-piercing rifle rounds	Highest rifle protection.
Special Type	Custom threats	For non-standard calibers or unique scenarios.

3. Definitions

- Clarifies terms like *backface signature*, *fair hit*, *ballistic limit*, *armor carrier*, etc.

4. Sample Requirements & Laboratory Configuration

- **Test Samples:** Flexible vests, hard plates, accessory panels.

- **Workmanship & Labeling:** Must meet strict quality and identification requirements.
- **Lab Setup:** Range configuration, test rounds/barrels, velocity measurement, submersion equipment, backing material.

5. Flexible Armor Conditioning Protocol

- Pre-test storage and calibration.
- Conditioning simulates wear, humidity, and temperature exposure.
- Ensures armor is tested under realistic degraded conditions.

6. Hard Armor Conditioning Protocol

- Similar to flexible armor but tailored for rigid plates.
- Includes drop tests, temperature cycling, and environmental exposure.

7. Ballistic Test Methods

- **Workmanship Examination:** Inspect carriers, panels, labels.
- **Sampling & Acclimation:** Define how many samples and how they're prepared.
- **Fair Hit Requirements:** Minimum shot-to-edge and shot-to-shot distances.
- **Backing Material Preparation:** Simulates human tissue response.
- **Perforation & Backface Signature (P-BFS):**
 - Measures penetration and blunt trauma.
 - Defines shot locations, submersion, threats, duration, number of shots.
- **Ballistic Limit (BL) Determination:**
 - Establishes the velocity at which armor consistently stops rounds.
 - Requires multiple samples and statistical tabulation.

8. References

- Lists supporting standards, test methods, and related NIJ/DoD documents.

□ Why This Matters

- Provides **uniform classification** so agencies know what level of protection armor offers.
- Ensures **repeatable laboratory testing** across manufacturers.

- Incorporates **conditioning protocols** to simulate real-world wear and environmental stress.
- Defines **performance metrics** (P-BFS, BL) that balance penetration resistance with blunt trauma safety.

Would you like me to **map these NIJ armor levels (IIA-IV + Special Type)** into a **comparison table with real-world use cases** (e.g., patrol officers, SWAT, military rifle threats), so you can see how each classification aligns with operational environments?

□ NIJ Ballistic Armor Classifications

Type	Threat Rounds	Test Conditions (New vs. Conditioned)	Notes
IIA	9 mm FMJ RN (124 gr, 373 m/s ± 9.1) .40 S&W FMJ (180 gr, 352 m/s ± 9.1)	Conditioned: 9 mm at 355 m/s ± 9.1 ; .40 S&W at 325 m/s ± 9.1	Lowest handgun protection; designed for 9 mm & .40 S&W.
II	9 mm FMJ RN (124 gr, 398 m/s ± 9.1) .357 Magnum JSP (158 gr, 436 m/s ± 9.1)	Conditioned: 9 mm at 379 m/s ± 9.1 ; .357 Magnum at 408 m/s ± 9.1	Higher handgun protection; includes .357 Magnum.
IIIA	.357 SIG FMJ FN (125 gr, 448 m/s ± 9.1) .44 Magnum SJHP (240 gr, 436 m/s ± 9.1)	Conditioned: .357 SIG at 430 m/s ± 9.1 ; .44 Magnum at 408 m/s ± 9.1	Highest handgun protection; includes magnum rounds.
III	7.62 mm FMJ (M80, 147 gr, 847 m/s ± 9.1)	Tested in conditioned state (hard armor); both new & conditioned (flexible armor)	Rifle protection; hard plates often tested “in conjunction” with soft armor.
IV	.30 caliber AP (M2 AP, 166 gr, 878 m/s ± 9.1)	Tested in conditioned state (hard armor); both new & conditioned (flexible armor)	Highest rifle protection; armor-piercing threats.
Special Type	Custom threats specified by purchaser	Reference velocities defined in Appendix B	Covers non-standard calibers or unique operational threats.

Classification rule: If a panel provides multiple levels of protection in different areas, its classification = **minimum protection level** anywhere on the panel.

□ Key Definitions

Term	Definition
Absolute Humidity	Quantity of water in a given volume of air (g/m ³).
Accessory Ballistic Panels	Detachable/removable armor components (groin, coccyx, side panels) that provide comparable ballistic protection but are not integral to the main armor.
Angle of Incidence	Angle between bullet's flight path and perpendicular to the backing material surface.
Armor Carrier	Component of the armor sample/panel whose primary purpose is to hold ballistic panels.

Today

You said

I want to create an image. Ask me questions about the subject, setting, and style I want.

Copilot said

Perfect, let's shape your vision together □. To make sure the image comes out exactly how you imagine it, I'll ask you a few guiding questions:

- Subject: What should be the main focus of the image? (e.g., a person, an object, a landscape, an abstract concept)
- Setting: Where or in what environment should this subject appear? (e.g., futuristic city, natural forest, underwater, outer space)
- Style: How should the image feel or look? (e.g., realistic photography, watercolor painting, cyberpunk digital art, minimalist sketch)
- Mood: Do you want the image to convey a particular emotion or atmosphere? (e.g., peaceful, dramatic, mysterious, joyful)
- Details: Any specific colors, props, or features you want included? (e.g., glowing lights, stormy sky, golden tones)

Would you like me to help by suggesting a few **ready-made combinations**—like a surreal desert scene in watercolor, a neon cyberpunk street in

digital art, or a serene mountain lake in photorealism—or do you already have a clear idea in mind?

□ **What MIL-STD-810 Is**

- Environmental test standard: Defines how equipment should be tested against stresses like temperature, humidity, vibration, and shock.
- Purpose: Ensures gear can survive the full range of conditions it will face during its service life.
- Scope: Covers altitude, temperature extremes, rain, humidity, fungus, salt fog, sand/dust, explosive atmospheres, leakage, acceleration, transport shock, gunfire vibration, and random vibration.

□ **Evolution**

- 1945 AAF Specification 41065: The ancestor of MIL-STD-810.
- 1962 MIL-STD-810 first edition: Allowed tailoring tests to reflect environmental conditions.
- MIL-STD-810D: Major revision focusing on shock and vibration realism.
- MIL-STD-810F: Expanded test methods, emphasizing simulated life-cycle conditions.
- MIL-STD-810G: Introduced multi-axis vibration testing (Test Method 527).
- MIL-STD-810H: Current version (2019, updated in 2022 with Change Notice 1).

⚖ **Key Principles**

- Tailoring: Tests are adapted to the specific equipment and its expected environment.
- Laboratory vs. field: Lab tests simulate stresses but can't fully replicate real-world conditions.
- Deficiency detection: Identifies weaknesses in design, materials, manufacturing, packaging, and maintenance.
- Tri-Service partnership: Maintained by the U.S. Army, Air Force, and Navy, with ATEC as lead.

□ **Why It Matters**

- Used not only for military gear but also for ruggedized consumer products (phones, laptops, vehicles).
- Provides confidence in durability and reliability across harsh environments.
- Forms part of contractual compliance in defense procurement.

Would you like me to **map this into an audit-ready table or checklist** (e.g., test categories, methods, applicability) so you can use it directly in your compliance or teaching frameworks, or would you prefer a **visual logigram/flowchart** showing how equipment moves through MIL-STD-810 testing phases?

You said

gions Part Three contains a compendium of climatic data and guidance assembled from several sources, including AR 70-38, Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions (1979),[11] a draft version of AR 70-38 (1990) that was developed using Air Land Battlefield Environment (ALBE) report information, Environmental Factors and Standards for Atmospheric Obscurants, Climate, and Terrain (1987), and MIL-HDBK-310, Global Climatic Data for Developing Military Products.[12] It also provides planning guidance for realistic consideration (i.e., starting points) of climatic conditions in various regions

□ Part Three - Climatic Regions

- **AR 70-38 (1979):** Guidance for materiel in extreme climatic conditions.
- **Draft AR 70-38 (1990):** Built on Air Land Battlefield Environment (ALBE) data.
- **Environmental Factors and Standards (1987):** Covered atmospheric obscurants, climate, and terrain.
- **MIL-HDBK-310 (1997):** Global climatic data for developing military products.
- **Purpose:** Provides planning guidance and realistic starting points for considering climatic conditions worldwide.

□ Applicability to Ruggedized Consumer Products

- **Flexible tailoring:** Vendors can adapt test methods to their products.
- **No certification authority:** Claims of “MIL-STD-810 compliant” can be misleading.
- **Verification needed:** Consumers should check:
 - Which **test methods** were used.
 - Which **parameter limits** were applied.
 - Whether testing was **internal or independent**.

□ Related Documents

- **DO-160G (RTCA):** Environmental conditions for airborne equipment.

- **DEF STAN 00-35 (UK MoD)**: Environmental test methods for defence materiel.
- **NATO AECTP-100**: Environmental guidelines for defence equipment.
- **MIL-DTL-901E (2017)**: Shock testing for naval shipboard machinery and systems.
- **IEST Recommended Practices**: Peer-reviewed vibration and shock testing methods.

□ See Also

- **IP Code** (Ingress Protection)
- **Rugged computer**
- **Rugged smartphone**
- **EN 62262** (IK code for impact resistance)
- **Industrial PC**

This section is particularly useful for **audit-ready checklists** because it highlights the *lack of certification authority* in consumer claims and the need to specify **test methods, limits, and facilities**. It also situates MIL-STD-810 within a broader ecosystem of standards (RTCA, DEF STAN, NATO, MIL-DTL-901E).

Would you like me to **normalize this into a comparative table** (e.g., MIL-STD-810 vs DO-160G vs DEF STAN 00-35 vs AECTP-100 vs MIL-DTL-901E) so you can quickly show students or auditors how these documents align and differ? That would make the relationships between standards crystal clear.

?

Rapid start: Excel VBA to normalize pasted article text into a checklist

This macro parses a block of text (pasted into Sheet1!A1) and builds an audit-ready table of sections on Sheet2. It detects major headings and creates rows you can later fill with method IDs, parameter limits, and test facility details.

```
vba
Option Explicit
```

```
Sub BuildMilStd810Checklist()
    Dim src As String, lines() As String
    Dim i As Long, rowOut As Long
    Dim currentSection As String

    ' Read source text from Sheet1!A1 (paste article text there)
```



```

src = Sheet1.Range("A1").Value
If Len(src) = 0 Then
    MsgBox "Paste the MIL-STD-810 article text into Sheet1!A1 first.",
vbExclamation
    Exit Sub
End If

' Prepare output sheet
With Sheet2
    .Cells.Clear
    .Range("A1").Value = "Section"
    .Range("B1").Value = "Requirement/Focus"
    .Range("C1").Value = "Test Methods Referenced"
    .Range("D1").Value = "Parameter Limits"
    .Range("E1").Value = "Evidence (Report/Facility)"
    .Range("F1").Value = "Notes"
    rowOut = 2
End With

' Split into lines
lines = Split(src, vbLf)

' Simple section detection patterns
Dim sectionPatterns As Variant
sectionPatterns = Array(
    "Cognizant agency", "Scope and purpose", "History and evolution", _
    "Part one", "Part two", "Part three", _
    "Applicability to ""ruggedized"" consumer products", "Related
documents", _
    "See also", "References", "External links", "MIL-STD-810H", "MIL-STD-
810G")

' Process lines
For i = LBound(lines) To UBound(lines)
    Dim ln As String
    ln = Trim(lines(i))
    If ln = "" Then GoTo ContinueLoop

    ' Normalize quotation marks
    ln = Replace(ln, """", "")
    ln = Replace(ln, "'", "")

    ' Detect section headers
    Dim p As Long
    For p = LBound(sectionPatterns) To UBound(sectionPatterns)
        If InStr(1, LCase$(ln), LCase$(sectionPatterns(p)),
vbTextCompare) > 0 Then
            currentSection = sectionPatterns(p)
            ' Write a new row for this section
            Sheet2.Cells(rowOut, 1).Value = currentSection
            ' Seed common content hints
            Select Case currentSection
                Case "Part two"
                    Sheet2.Cells(rowOut, 2).Value = "Laboratory test
methods and tailoring"

```

```

        Sheet2.Cells(rowOut, 3).Value = "e.g., Method 501.7
High Temp; 502.7 Low Temp; 507.6 Humidity; 510.7 Sand/Dust; 514.8 Vibration;
516.8 Shock"
        Case "Part three"
            Sheet2.Cells(rowOut, 2).Value = "Climatic regions
planning guidance (AR 70-38, MIL-HDBK-310)"
            Case "Applicability to ""ruggedized"" consumer products"
                Sheet2.Cells(rowOut, 2).Value = "Verify claims:
methods, limits, internal vs independent testing"
            Case "Cognizant agency"
                Sheet2.Cells(rowOut, 2).Value = "Tri-Service
(Army/Air Force/Navy); ATEC lead"
            Case "Scope and purpose"
                Sheet2.Cells(rowOut, 2).Value = "Environmental
stresses across lifecycle; tailoring; limits of lab simulation"
            Case "History and evolution"
                Sheet2.Cells(rowOut, 2).Value = "Evolution of
tailoring; multi-axis vibration (TM 527); 810H current"
            End Select
            rowOut = rowOut + 1
            GoTo ContinueLoop
        End If
    Next p

    ' If line belongs to a section, append useful keywords into Notes
    If currentSection <> "" Then
        If Len(ln) > 10 Then
            Dim existing As String
            existing = Sheet2.Cells(rowOut - 1, 6).Value
            If Len(existing) > 0 Then
                Sheet2.Cells(rowOut - 1, 6).Value = existing & " | " & ln
            Else
                Sheet2.Cells(rowOut - 1, 6).Value = ln
            End If
        End If
    End If
End If

ContinueLoop:
Next i

' Format as table
With Sheet2.Range("A1:F" & rowOut - 1)
    .Columns.AutoFit
    .Borders.LineStyle = xlContinuous
End With

MsgBox "Checklist generated on Sheet2.", vbInformation
End Sub

```

VB.NET console: extract headings and emit CSV for audit

This version takes a text file of the article and produces a CSV you can import to your QMS artifacts.

```

vbnet
Imports System.IO
Imports System.Text
Imports System.Text.RegularExpressions

Module Program
    Sub Main(args As String())
        If args.Length = 0 Then
            Console.WriteLine("Usage: MilStd810Parse.exe <input.txt>
[output.csv]")
            Return
        End If
        Dim inputPath = args(0)
        Dim outputPath = If(args.Length > 1, args(1),
"milstd810_checklist.csv")

        Dim src As String = File.ReadAllText(inputPath)
        Dim lines = src.Split({vbCr, vbLf},
StringSplitOptions.RemoveEmptyEntries)

        Dim sections As New List(Of String) From {
            "Cognizant agency",
            "Scope and purpose",
            "History and evolution",
            "Part one",
            "Part two",
            "Part three",
            "Applicability to ""ruggedized"" consumer products",
            "Related documents",
            "See also"
        }

        Dim current As String = ""
        Dim rows As New List(Of String)
        rows.Add("Section,Requirement/Focus,Test Methods Referenced,Parameter
Limits,Evidence,Notes")

        For Each raw In lines
            Dim ln = raw.Trim()
            If ln = "" Then Continue For

            ' Detect section header (case-insensitive contains)
            Dim matched = sections.FirstOrDefault(Function(s) ln.IndexOf(s,
StringComparison.OrdinalIgnoreCase) >= 0)
            If matched IsNot Nothing Then
                current = matched
                Dim focus As String = ""
                Select Case matched
                    Case "Part two" : focus = "Laboratory test methods and
tailoring"
                    Case "Part three" : focus = "Climatic regions planning
guidance"
                    Case "Applicability to ""ruggedized"" consumer
products" : focus = "Verify claims (methods, limits, facility)"

```

```

        Case "Cognizant agency" : focus = "Tri-Service
partnership, ATEC lead"
        Case "Scope and purpose" : focus = "Lifecycle
environmental stresses; tailoring"
        Case "History and evolution" : focus = "Evolution, multi-
axis vibration (TM 527), 810H current"
        Case Else : focus = ""
    End Select
    rows.Add(Escape(matched) & "," & Escape(focus) & ",,," & "")
ElseIf current <> "" Then
    ' Accumulate notes under current section
    Dim idx = rows.Count - 1
    Dim parts = rows(idx).Split(",")
    ' Append to Notes
    parts(parts.Length - 1) = CombineNote(parts(parts.Length -
1), ln)
    rows(idx) = String.Join(",", parts)
End If
Next

File.WriteAllLines(outputPath, rows, Encoding.UTF8)
Console.WriteLine("CSV written: " & outputPath)
End Sub

Private Function Escape(s As String) As String
    If s Is Nothing Then Return ""
    s = s.Replace("","")
    Return "" & s & ""
End Function

Private Function CombineNote(existing As String, add As String) As String
    If String.IsNullOrEmpty(existing) Then Return add
    Return existing & " | " & add
End Function
End Module

```

What I need to tailor it perfectly

- **Environment:** Excel VBA, Access VBA, or VB.NET?
- **Output format:** Table in Excel, CSV/JSON, or a Word report?
- **Granularity:** Do you want auto-detection of specific test methods (e.g., 501.x, 502.x, 507.x, 510.x, 514.x, 516.x, 527) and automatic columns for severity, duration, cycles?
- **Workflow:** Should this plug into your existing inspection flow or supplier audit logigram?

If you share a small sample of the exact text block you paste and your target columns, I'll wire the parser to extract method IDs, parameter limits, and facility evidence with regex and output a fillable, audit-ready artifact.

.

□ VBA Macro: Parse MIL-STD-810 Text into Audit Checklist

vba

Option Explicit

```
Sub ParseMilStd810Text()  
    Dim src As String, lines() As String  
    Dim i As Long, rowOut As Long  
    Dim currentSection As String  
  
    ' Read source text from Sheet1!A1 (paste article text there)  
    src = Sheet1.Range("A1").Value  
    If Len(src) = 0 Then  
        MsgBox "Paste the MIL-STD-810 article text into Sheet1!A1 first.",  
vbExclamation  
        Exit Sub  
    End If  
  
    ' Prepare output sheet  
    With Sheet2  
        .Cells.Clear  
        .Range("A1").Value = "Section"  
        .Range("B1").Value = "Focus"  
        .Range("C1").Value = "Test Methods"  
        .Range("D1").Value = "Parameter Limits"  
        .Range("E1").Value = "Evidence"  
        .Range("F1").Value = "Notes"  
        rowOut = 2  
    End With  
  
    ' Split into lines  
    lines = Split(src, vbLf)  
  
    ' Section keywords to detect  
    Dim sectionPatterns As Variant  
    sectionPatterns = Array( _  
        "Applicability to ""ruggedized"" consumer products", _  
        "Related documents", _  
        "See also", _  
        "References")  
  
    ' Process lines  
    For i = LBound(lines) To UBound(lines)  
        Dim ln As String  
        ln = Trim(lines(i))  
        If ln = "" Then GoTo ContinueLoop  
  
        ' Detect section headers  
        Dim p As Long  
        For p = LBound(sectionPatterns) To UBound(sectionPatterns)  
            If InStr(1, LCase$(ln), LCase$(sectionPatterns(p)),  
vbTextCompare) > 0 Then  
                currentSection = sectionPatterns(p)  
                ' Write a new row for this section
```

```

        Sheet2.Cells(rowOut, 1).Value = currentSection
        Select Case currentSection
            Case "Applicability to ""ruggedized"" consumer products"
                Sheet2.Cells(rowOut, 2).Value = "Verify vendor
claims; check methods, limits, facility"
            Case "Related documents"
                Sheet2.Cells(rowOut, 2).Value = "Cross-reference D0-
160G, DEF STAN 00-35, AECTP-100, MIL-DTL-901E"
            Case "See also"
                Sheet2.Cells(rowOut, 2).Value = "IP Code, Rugged
computer, EN 62262"
            Case "References"
                Sheet2.Cells(rowOut, 2).Value = "Source citations for
MIL-STD-810 evolution"
        End Select
        rowOut = rowOut + 1
        GoTo ContinueLoop
    End If
Next p

' Append notes under current section
If currentSection <> "" Then
    Dim existing As String
    existing = Sheet2.Cells(rowOut - 1, 6).Value
    If Len(existing) > 0 Then
        Sheet2.Cells(rowOut - 1, 6).Value = existing & " | " & ln
    Else
        Sheet2.Cells(rowOut - 1, 6).Value = ln
    End If
End If

ContinueLoop:
Next i

' Format as table
With Sheet2.Range("A1:F" & rowOut - 1)
    .Columns.AutoFit
    .Borders.LineStyle = xlContinuous
End With

MsgBox "Checklist generated on Sheet2.", vbInformation
End Sub

```

□ How It Works

- Paste the MIL-STD-810 text into **Sheet1!A1**.
- Run the macro → it scans for section headers like *Applicability*, *Related documents*, *See also*, *References*.
- It builds a structured table on **Sheet2** with columns for **Section**, **Focus**, **Test Methods**, **Parameter Limits**, **Evidence**, **Notes**.
- Notes column accumulates the raw text for later review.

This gives you a **repeatable audit artifact generator**: every time you paste a new MIL-STD-810 excerpt, you get a normalized checklist ready for tailoring.

Would you like me to extend this so it **auto-detects specific test methods** (like 501.7 High Temp, 502.7 Low Temp, 507.6 Humidity, 510.7 Sand/Dust, 514.8 Vibration, 516.8 Shock) and places them into the *Test Methods* column automatically? That would make it even more inspection-ready.

Copilot said

I see you're asking again for **Visual Basic code** in the context of MIL-STD-810 and the Wikipedia excerpt you pasted. Let me give you a practical, reusable snippet that helps you **extract and structure sections like "Applicability to ruggedized consumer products" and "Related documents" into an audit-ready table**. This way, you can paste long text blocks (like the article) into Excel and automatically generate structured rows for compliance review.

□ Excel VBA Macro: Build MIL-STD-810 Audit Checklist

```
vba
Option Explicit

Sub BuildMilStd810AuditChecklist()
    Dim src As String, lines() As String
    Dim i As Long, rowOut As Long
    Dim currentSection As String

    ' Read source text from Sheet1!A1 (paste article text there)
    src = Sheet1.Range("A1").Value
    If Len(src) = 0 Then
        MsgBox "Paste the MIL-STD-810 article text into Sheet1!A1 first.",
vbExclamation
        Exit Sub
    End If

    ' Prepare output sheet
    With Sheet2
        .Cells.Clear
        .Range("A1").Value = "Section"
        .Range("B1").Value = "Focus"
        .Range("C1").Value = "Test Methods"
        .Range("D1").Value = "Parameter Limits"
        .Range("E1").Value = "Evidence"
        .Range("F1").Value = "Notes"
        rowOut = 2
    End With

    ' Split into lines
```

```

lines = Split(src, vbLf)

' Section keywords to detect
Dim sectionPatterns As Variant
sectionPatterns = Array( _
    "Applicability to ""ruggedized"" consumer products", _
    "Related documents", _
    "See also", _
    "References")

' Process lines
For i = LBound(lines) To UBound(lines)
    Dim ln As String
    ln = Trim(lines(i))
    If ln = "" Then GoTo ContinueLoop

    ' Detect section headers
    Dim p As Long
    For p = LBound(sectionPatterns) To UBound(sectionPatterns)
        If InStr(1, LCase$(ln), LCase$(sectionPatterns(p)),
vbTextCompare) > 0 Then
            currentSection = sectionPatterns(p)
            ' Write a new row for this section
            Sheet2.Cells(rowOut, 1).Value = currentSection
            Select Case currentSection
                Case "Applicability to ""ruggedized"" consumer products"
                    Sheet2.Cells(rowOut, 2).Value = "Verify vendor
claims; check methods, limits, facility"
                Case "Related documents"
                    Sheet2.Cells(rowOut, 2).Value = "Cross-reference D0-
160G, DEF STAN 00-35, AECTP-100, MIL-DTL-901E"
                Case "See also"
                    Sheet2.Cells(rowOut, 2).Value = "IP Code, Rugged
computer, EN 62262"
                Case "References"
                    Sheet2.Cells(rowOut, 2).Value = "Source citations for
MIL-STD-810 evolution"
            End Select
            rowOut = rowOut + 1
            GoTo ContinueLoop
        End If
    Next p

    ' Append notes under current section
    If currentSection <> "" Then
        Dim existing As String
        existing = Sheet2.Cells(rowOut - 1, 6).Value
        If Len(existing) > 0 Then
            Sheet2.Cells(rowOut - 1, 6).Value = existing & " | " & ln
        Else
            Sheet2.Cells(rowOut - 1, 6).Value = ln
        End If
    End If
End If

ContinueLoop:

```



```

Next i

' Format as table
With Sheet2.Range("A1:F" & rowOut - 1)
    .Columns.AutoFit
    .Borders.LineStyle = xlContinuous
End With

MsgBox "Audit checklist generated on Sheet2.", vbInformation
End Sub

```

□ How to Use

1. Paste the Wikipedia MIL-STD-810 text into **Sheet1!A1**.
2. Run the macro.
3. It scans for section headers (*Applicability, Related documents, See also, References*).
4. It builds a structured table on **Sheet2** with columns for **Section, Focus, Test Methods, Parameter Limits, Evidence, Notes**.
5. The *Notes* column accumulates the raw text for later review.

This gives you a **repeatable audit artifact generator**: every time you paste a new MIL-STD-810 excerpt, you get a normalized checklist ready for tailoring and compliance.

Would you like me to extend this so it **auto-detects specific test methods** (like 501.7 High Temp, 502.7 Low Temp, 507.6 Humidity, 510.7 Sand/Dust, 514.8 Vibration, 516.8 Shock) and places them into the *Test Methods* column automatically? That would make it even more inspection-ready.

Compliance and Engineering Documentation in MIL-STD-100G and IEC 62368-1:2024

Synthesis of Key Compliance, Engineering, and Documentation Requirements from MIL-STD-100G and IEC 62368-1:2024 for Electrical and Electronic Product Design

Introduction

The design and documentation of electrical and electronic products—especially those intended for ruggedized or safety-critical applications—require strict adherence to internationally recognized standards. Two of the most influential standards in this domain are **MIL-STD-100G**, the U.S. Department of Defense’s standard for engineering drawings, and **IEC**

62368-1:2024, the latest edition of the international hazard-based safety standard for audio/video, information, and communication technology equipment. As technology evolves and product categories converge, understanding the intersection of these standards is critical for manufacturers, engineers, and compliance professionals working on products that must meet both military and commercial safety and documentation requirements.

This report provides a comprehensive synthesis of the key compliance, engineering, and documentation requirements from MIL-STD-100G and IEC 62368-1:2024. It focuses on their intersection in the context of electrical and electronic product design, with particular attention to ruggedized and safety-critical systems. The analysis covers scope and applicability, drawing practices, safety documentation, qualification procedures, change management, and regulatory pathways, and concludes with a comparative analysis supported by detailed tables and in-depth discussion.

Scope and Applicability: MIL-STD-100G vs. IEC 62368-1:2024

MIL-STD-100G

MIL-STD-100G establishes the essential requirements for the preparation and revision of engineering drawings and associated lists for or by U.S. Department of Defense (DoD) agencies. Its scope is tightly focused on government-unique requirements, particularly where DoD logistics support or design activity is required. The standard is to be used in conjunction with ASME Y14.100M and related ASME standards for engineering drawing practices. MIL-STD-100G is primarily invoked when government design activity is fully justified, or when government logistics support is necessary. It is not intended for general commercial use unless specifically required by contract

vba

Option Explicit

Sub ParseMilStd810Text()

Dim src As String, lines() As String

Dim i As Long, rowOut As Long

Dim currentSection As String

' Read source text from Sheet1!A1 (paste article text there)

src = Sheet1.Range("A1").Value

If Len(src) = 0 Then

MsgBox "Paste the MIL-STD-810 article text into Sheet1!A1 first.",

vbExclamation

Exit Sub

```

End If

' Prepare output sheet
With Sheet2
    .Cells.Clear
    .Range("A1").Value = "Section"
    .Range("B1").Value = "Focus"
    .Range("C1").Value = "Test Methods"
    .Range("D1").Value = "Parameter Limits"
    .Range("E1").Value = "Evidence"
    .Range("F1").Value = "Notes"
    rowOut = 2
End With

' Split into lines
lines = Split(src, vbLf)

' Section keywords to detect
Dim sectionPatterns As Variant
sectionPatterns = Array( _
    "Applicability to ""ruggedized"" consumer products", _
    "Related documents", _
    "See also", _
    "References")

' Process lines
For i = LBound(lines) To UBound(lines)
    Dim ln As String
    ln = Trim(lines(i))
    If ln = "" Then GoTo ContinueLoop

    ' Detect section headers
    Dim p As Long
    For p = LBound(sectionPatterns) To UBound(sectionPatterns)
        If InStr(1, LCase$(ln), LCase$(sectionPatterns(p)),
vbTextCompare) > 0 Then
            currentSection = sectionPatterns(p)
            ' Write a new row for this section
            Sheet2.Cells(rowOut, 1).Value = currentSection
            Select Case currentSection
                Case "Applicability to ""ruggedized"" consumer products"
                    Sheet2.Cells(rowOut, 2).Value = "Verify vendor
claims; check methods, limits, facility"
                Case "Related documents"
                    Sheet2.Cells(rowOut, 2).Value = "Cross-reference D0-
160G, DEF STAN 00-35, AECTP-100, MIL-DTL-901E"
                Case "See also"
                    Sheet2.Cells(rowOut, 2).Value = "IP Code, Rugged
computer, EN 62262"
                Case "References"
                    Sheet2.Cells(rowOut, 2).Value = "Source citations for
MIL-STD-810 evolution"
            End Select
            rowOut = rowOut + 1
            GoTo ContinueLoop
        End If
    Next p
End For

```

```

        End If
    Next p

    ' Append notes under current section
    If currentSection <> "" Then
        Dim existing As String
        existing = Sheet2.Cells(rowOut - 1, 6).Value
        If Len(existing) > 0 Then
            Sheet2.Cells(rowOut - 1, 6).Value = existing & " | " & ln
        Else
            Sheet2.Cells(rowOut - 1, 6).Value = ln
        End If
    End If
End If

ContinueLoop:
Next i

' Format as table
With Sheet2.Range("A1:F" & rowOut - 1)
    .Columns.AutoFit
    .Borders.LineStyle = xlContinuous
End With

MsgBox "Checklist generated on Sheet2.", vbInformation
End Sub

```

□ How It Works

- Paste the MIL-STD-810 text into **Sheet1!A1**.
- Run the macro → it scans for section headers like *Applicability*, *Related documents*, *See also*, *References*.
- It builds a structured table on **Sheet2** with columns for **Section**, **Focus**, **Test Methods**, **Parameter Limits**, **Evidence**, **Notes**.
- Notes column accumulates the raw text for later review.

This gives you a **repeatable audit artifact generator**: every time you paste a new MIL-STD-810 excerpt, you get a normalized checklist ready for tailoring.

Would you like me to extend this so it **auto-detects specific test methods** (like 501.7 High Temp, 502.7 Low Temp, 507.6 Humidity, 510.7 Sand/Dust, 514.8 Vibration, 516.8 Shock) and places them into the *Test Methods* column automatically? That would make it even more inspection-ready.

Copilot said

I see you're asking again for **Visual Basic code** in the context of MIL-STD-810 and the Wikipedia excerpt you pasted. Let me give you a practical, reusable snippet that helps you **extract and structure sections**

like “Applicability to ruggedized consumer products” and “Related documents” into an audit-ready table. This way, you can paste long text blocks (like the article) into Excel and automatically generate structured rows for compliance review.

□ **Excel VBA Macro: Build MIL-STD-810 Audit Checklist**

```
vba
Option Explicit

Sub BuildMilStd810AuditChecklist()
    Dim src As String, lines() As String
    Dim i As Long, rowOut As Long
    Dim currentSection As String

    ' Read source text from Sheet1!A1 (paste article text there)
    src = Sheet1.Range("A1").Value
    If Len(src) = 0 Then
        MsgBox "Paste the MIL-STD-810 article text into Sheet1!A1 first.",
vbExclamation
        Exit Sub
    End If

    ' Prepare output sheet
    With Sheet2
        .Cells.Clear
        .Range("A1").Value = "Section"
        .Range("B1").Value = "Focus"
        .Range("C1").Value = "Test Methods"
        .Range("D1").Value = "Parameter Limits"
        .Range("E1").Value = "Evidence"
        .Range("F1").Value = "Notes"
        rowOut = 2
    End With

    ' Split into lines
    lines = Split(src, vbLf)

    ' Section keywords to detect
    Dim sectionPatterns As Variant
    sectionPatterns = Array( _
        "Applicability to ""ruggedized"" consumer products", _
        "Related documents", _
        "See also", _
        "References")

    ' Process lines
    For i = LBound(lines) To UBound(lines)
        Dim ln As String
        ln = Trim(lines(i))
        If ln = "" Then GoTo ContinueLoop

        ' Detect section headers
```

```

        Dim p As Long
        For p = LBound(sectionPatterns) To UBound(sectionPatterns)
            If InStr(1, LCase$(ln), LCase$(sectionPatterns(p)),
vbTextCompare) > 0 Then
                currentSection = sectionPatterns(p)
                ' Write a new row for this section
                Sheet2.Cells(rowOut, 1).Value = currentSection
                Select Case currentSection
                    Case "Applicability to ""ruggedized"" consumer products"
                        Sheet2.Cells(rowOut, 2).Value = "Verify vendor
claims; check methods, limits, facility"
                    Case "Related documents"
                        Sheet2.Cells(rowOut, 2).Value = "Cross-reference D0-
160G, DEF STAN 00-35, AECTP-100, MIL-DTL-901E"
                    Case "See also"
                        Sheet2.Cells(rowOut, 2).Value = "IP Code, Rugged
computer, EN 62262"
                    Case "References"
                        Sheet2.Cells(rowOut, 2).Value = "Source citations for
MIL-STD-810 evolution"
                End Select
                rowOut = rowOut + 1
                GoTo ContinueLoop
            End If
        Next p

        ' Append notes under current section
        If currentSection <> "" Then
            Dim existing As String
            existing = Sheet2.Cells(rowOut - 1, 6).Value
            If Len(existing) > 0 Then
                Sheet2.Cells(rowOut - 1, 6).Value = existing & " | " & ln
            Else
                Sheet2.Cells(rowOut - 1, 6).Value = ln
            End If
        End If

ContinueLoop:
    Next i

    ' Format as table
    With Sheet2.Range("A1:F" & rowOut - 1)
        .Columns.AutoFit
        .Borders.LineStyle = xlContinuous
    End With

    MsgBox "Audit checklist generated on Sheet2.", vbInformation
End Sub

```

□ How to Use

1. Paste the Wikipedia MIL-STD-810 text into **Sheet1!A1**.
2. Run the macro.

3. It scans for section headers (*Applicability, Related documents, See also, References*).
4. It builds a structured table on **Sheet2** with columns for **Section, Focus, Test Methods, Parameter Limits, Evidence, Notes**.
5. The *Notes* column accumulates the raw text for later review.

This gives you a **repeatable audit artifact generator**: every time you paste a new MIL-STD-810 excerpt, you get a normalized checklist ready for tailoring and compliance.

Would you like me to extend this so it **auto-detects specific test methods** (like 501.7 High Temp, 502.7 Low Temp, 507.6 Humidity, 510.7 Sand/Dust, 514.8 Vibration, 516.8 Shock) and places them into the *Test Methods* column automatically? That would make it even more inspection-ready.

You said

Copilot said

Thanks for sharing the image, Tshingombe — it's a rich educational matrix covering technical, academic, and regulatory domains. Since you've been building Visual Basic routines for parsing and structuring standards like MIL-STD-810, let's now extend that logic to **extract structured Q&A pairs from this kind of spreadsheet** and convert them into an **audit-ready table or searchable knowledge base**.

□ Excel VBA Macro: Extract Q&A from Sheet and Normalize for Audit or Study

This macro assumes your questions are in **Column A** and answers in **Column B** of Sheet1. It outputs a structured table in Sheet2 with columns for **Topic, Question, Answer**, and **Tags** (auto-generated from keywords).

```
vba
Option Explicit
```

```
Sub NormalizeQAContent()
    Dim wsSrc As Worksheet, wsOut As Worksheet
    Dim lastRow As Long, i As Long, rowOut As Long
    Dim q As String, a As String, topic As String, tags As String

    Set wsSrc = ThisWorkbook.Sheets("Sheet1")
    Set wsOut = ThisWorkbook.Sheets("Sheet2")
```

```

wsOut.Cells.Clear
wsOut.Range("A1:D1").Value = Array("Topic", "Question", "Answer", "Tags")
rowOut = 2

lastRow = wsSrc.Cells(wsSrc.Rows.Count, "A").End(xlUp).Row

For i = 1 To lastRow
    q = Trim(wsSrc.Cells(i, 1).Value)
    a = Trim(wsSrc.Cells(i, 2).Value)
    If q = "" Or a = "" Then GoTo ContinueLoop

    topic = InferTopic(q)
    tags = GenerateTags(q & " " & a)

    wsOut.Cells(rowOut, 1).Value = topic
    wsOut.Cells(rowOut, 2).Value = q
    wsOut.Cells(rowOut, 3).Value = a
    wsOut.Cells(rowOut, 4).Value = tags
    rowOut = rowOut + 1

ContinueLoop:
    Next i

    With wsOut.Range("A1:D" & rowOut - 1)
        .Columns.AutoFit
        .Borders.LineStyle = xlContinuous
    End With

    MsgBox "Q&A normalization complete on Sheet2.", vbInformation
End Sub

Function InferTopic(q As String) As String
    Dim ql As String: ql = LCase(q)
    If ql Like "*thermodynamics*" Or ql Like "*heat*" Then InferTopic =
"Thermodynamics": Exit Function
    If ql Like "*electrical*" Or ql Like "*voltage*" Or ql Like "*circuit*"
Then InferTopic = "Electrical Engineering": Exit Function
    If ql Like "*project*" Or ql Like "*documentation*" Then InferTopic =
"Project Management": Exit Function
    If ql Like "*education*" Or ql Like "*moderator*" Or ql Like "*assessor*"
Then InferTopic = "Education & Assessment": Exit Function
    If ql Like "*software*" Or ql Like "*gitlab*" Or ql Like "*programming*"
Then InferTopic = "Software Development": Exit Function
    If ql Like "*legal*" Or ql Like "*motion*" Then InferTopic = "Legal
Studies": Exit Function
    If ql Like "*physics*" Or ql Like "*energy*" Or ql Like "*gravity*" Then
InferTopic = "Physics": Exit Function
    If ql Like "*civil*" Or ql Like "*geotechnical*" Then InferTopic = "Civil
Engineering": Exit Function
    InferTopic = "General Knowledge"
End Function

Function GenerateTags(text As String) As String

```



```

Dim t As String: t = LCase(text)
Dim tags As String: tags = ""
If InStr(t, "heat") > 0 Then tags = tags & "heat,"
If InStr(t, "voltage") > 0 Then tags = tags & "voltage,"
If InStr(t, "project") > 0 Then tags = tags & "project,"
If InStr(t, "assessment") > 0 Then tags = tags & "assessment,"
If InStr(t, "software") > 0 Then tags = tags & "software,"
If InStr(t, "gitlab") > 0 Then tags = tags & "gitlab,"
If InStr(t, "physics") > 0 Then tags = tags & "physics,"
If InStr(t, "legal") > 0 Then tags = tags & "legal,"
If InStr(t, "transformer") > 0 Then tags = tags & "transformer,"
If InStr(t, "substation") > 0 Then tags = tags & "substation,"
If InStr(t, "diode") > 0 Then tags = tags & "diode,"
If InStr(t, "cop") > 0 Then tags = tags & "cop,"
If tags = "" Then tags = "general"
GenerateTags = Left(tags, Len(tags) - 1)
End Function

```

□ What This Enables

- **Audit-ready Q&A matrix:** You can tag, filter, and export by topic or keyword.
- **Curriculum mapping:** Align questions to learning outcomes or unit standards.
- **Portfolio integration:** Feed into PoE artifacts or assessment moderation logs.
- **Searchable knowledge base:** Use tags to build a searchable index or chatbot corpus.

Would you like me to extend this into a **logigram routine** that maps question types to assessment levels (e.g., Bloom's taxonomy or NQF descriptors)? That would let you scaffold cognitive complexity across your curriculum.

You said

Sales Order QUO-004535.pdf

PDF

ADA361444-1.pdf

PDF

Create a research report on

Copilot said

Okay, I've come up with a research plan. It will compare MIL-STD-100G and IEC 62368-1:2024 in the context of compliance, engineering drawing practices, and documentation for ruggedized and safety-critical systems.

Deep Research

Compliance and Engineering Documentation in MIL-STD-100G and IEC 62368-1:2024

Synthesis of Key Compliance, Engineering, and Documentation Requirements from MIL-STD-100G and IEC 62368-1:2024 for Electrical and Electronic Product Design

Introduction

The design and documentation of electrical and electronic products—especially those intended for ruggedized or safety-critical applications—require strict adherence to internationally recognized standards. Two of the most influential standards in this domain are **MIL-STD-100G**, the U.S. Department of Defense's standard for engineering drawings, and **IEC 62368-1:2024**, the latest edition of the international hazard-based safety standard for audio/video, information, and communication technology equipment. As technology evolves and product categories converge, understanding the intersection of these standards is critical for manufacturers, engineers, and compliance professionals working on products that must meet both military and commercial safety and documentation requirements.

This report provides a comprehensive synthesis of the key compliance, engineering, and documentation requirements from MIL-STD-100G and IEC 62368-1:2024. It focuses on their intersection in the context of electrical and electronic product design, with particular attention to ruggedized and safety-critical systems. The analysis covers scope and applicability, drawing practices, safety documentation, qualification procedures, change management, and regulatory pathways, and concludes with a comparative analysis supported by detailed tables and in-depth discussion.

Scope and Applicability: MIL-STD-100G vs. IEC 62368-1:2024

MIL-STD-100G

MIL-STD-100G establishes the essential requirements for the preparation and revision of engineering drawings and associated lists for or by U.S. Department of Defense (DoD) agencies. Its scope is tightly focused on government-unique requirements, particularly where DoD logistics support or design activity is required. The standard is to be used in conjunction with ASME Y14.100M and related ASME standards for engineering drawing practices. MIL-STD-100G is primarily invoked when government design activity is fully justified, or when government logistics support is necessary. It is not intended for general commercial use unless specifically required by contract

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IEC 62368-1:2024

IEC 62368-1:2024 is a globally recognized hazard-based safety standard for audio/video, information, and communication technology equipment. It replaces legacy standards IEC 60950-1 and IEC 60065, providing a unified, technology-neutral, and future-proof framework for product safety. The standard applies to a broad range of products with rated voltages not exceeding 600 V, including computers, telecommunications devices, power supplies, and more. Its hazard-based approach focuses on identifying energy sources and implementing safeguards, rather than prescribing specific construction requirements

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Comparative Analysis

While MIL-STD-100G is primarily concerned with the **documentation and control of engineering data** for defense applications, IEC 62368-1:2024 is focused on **product safety through hazard identification and mitigation** for a wide range of commercial and industrial products. However, both standards are highly relevant for ruggedized and safety-critical systems, especially where products must meet both military and commercial requirements.

Drawing Practices and Formats

Drawing Practices in MIL-STD-100G

MIL-STD-100G, in conjunction with ASME Y14.100M, defines the essential requirements for the preparation of engineering drawings and associated lists. Key elements include:

- **Drawing Types and Formats:** Types of drawings are defined per ASME Y14.24M and MIL-STD-100G Chapter 200, including detail, assembly, installation, and source control drawings. Each type serves a specific purpose in the product lifecycle

□ .

□ **Titles and Item Names:** Drawing titles must use approved item names from the Federal Item Name Directory (H6) and include sufficient modifiers for differentiation. The title block must clearly identify the design activity and CAGE code

□ .

□ **Numbering and Identification:** Unique drawing numbers and part or identifying numbers (PINs) are assigned and controlled by the design activity. The CAGE code and drawing number together provide unique identification

□ .

□ **Digital Data and CAD:** Drawings may be prepared manually or digitally. Digital data must provide all required information, and file formats must conform to standards such as IGES (MIL-PRF-28000), raster (MIL-PRF-28002), and SGML (MIL-PRF-28001) for text-based drawings

□ .

□ **Marking and Labelling:** Drawings must specify marking requirements for items and packages, including part identification, method of application, and materials, in accordance with MIL-STD-130 and MIL-STD-129

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- **Associated Lists:** Parts lists, data lists, and index lists are prepared per ASME Y14.34M and are assigned identifiers linked to the parent drawing.

Drawing Practices in IEC 62368-1:2024

IEC 62368-1:2024 does not prescribe detailed drawing formats but requires comprehensive documentation to support hazard identification, risk assessment, and verification of safeguards. Key documentation practices include:

- **Documentation of Safeguards:** Drawings and technical documents must clearly show the implementation of safeguards (e.g., insulation, enclosures, barriers) against identified hazards

□ .

□ **Component and Circuit Identification:** Schematics and layouts must identify energy sources (ES1, ES2, ES3), power sources (PS1, PS2, PS3), and the corresponding safeguards.

□ **Test Reports and Records:** Detailed test reports, including test setups, results, and compliance with specific clauses, are required for certification and traceability

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- **Change Control:** Documentation must be updated to reflect any changes affecting safety, including component substitutions, design modifications, or process changes.

Comparative Table: Drawing and Documentation Practices

Dimension	MIL-STD-100G	IEC 62368-1:2024
Drawing Types	Detail, assembly, installation, source control	Not prescriptive; requires documentation of safeguards and energy sources
Numbering/Identification	Unique drawing numbers, PINs, CAGE codes	Component/circuit identification for hazard assessment; no specific numbering system
Digital Data	IGES, raster, SGML, per MIL-PRF-28000/28002/28001	Electronic files required; format not prescribed, but must support traceability and clarity
Marking/Labelling	Specified on drawings per MIL-STD-130/129	Markings required for user safety, warnings, and identification of hazardous areas
Associated Lists	Parts, data, index lists per ASME Y14.34M	Bill of materials and critical component lists for safety assessment

Dimension	MIL-STD-100G	IEC 62368-1:2024
Change Control	Revision blocks, configuration management	Documentation of changes affecting safety; updated risk assessments

Analysis: MIL-STD-100G provides a highly structured approach to drawing preparation, numbering, and identification, ensuring traceability and control throughout the product lifecycle. IEC 62368-1:2024, while less prescriptive about drawing formats, requires documentation that supports hazard-based risk assessment and verification of safety measures. For ruggedized and safety-critical systems, integrating the structured documentation of MIL-STD-100G with the hazard-focused documentation of IEC 62368-1 ensures both traceability and safety compliance.

Engineering Change Control, Numbering, and Identification

MIL-STD-100G Requirements

Change control is a cornerstone of MIL-STD-100G, ensuring that all modifications to drawings, parts, or assemblies are properly documented and traceable. Key requirements include:

- **Change Requiring New Identification:** If a change affects performance, durability, interchangeability, or safety, a new PIN must be assigned to the part and all affected assemblies up to the level where interchangeability is restored

□ .

□ **Changes Not Requiring New Identification:** Minor changes that do not affect interchangeability or safety do not require a new PIN, but must be documented in the revision history.

□ **Revision Control:** All changes are recorded in the revision block of the drawing, with details of the change, date, and authorizing authority.

□ **Configuration Management:** MIL-STD-973 and MIL-HDBK-61 provide additional guidance on configuration management, ensuring that all changes are controlled, reviewed, and approved by the design authority

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IEC 62368-1:2024 Requirements

IEC 62368-1:2024 requires that any changes affecting safety—such as component substitutions, design modifications, or process changes—are evaluated for their impact on hazard mitigation and safeguards. Key practices include:

- **Risk Assessment Updates:** Any change that could affect the effectiveness of a safeguard must trigger a new risk assessment and, if necessary, additional testing.
- **Documentation of Changes:** All changes must be documented, including the rationale, impact assessment, and updated test reports if applicable.
- **Traceability:** Critical components and safety-related circuits must be traceable through documentation, including test records and supplier information
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Comparative Analysis

Both standards emphasize the importance of change control and traceability, but MIL-STD-100G provides a more formalized structure for numbering and identification, while IEC 62368-1:2024 focuses on the impact of changes on safety and the need for updated risk assessments. For safety-critical systems, integrating both approaches ensures that changes are both traceable and evaluated for safety implications.

Safety Documentation and Hazard-Based Risk Assessment

MIL-STD-100G: Critical Safety Characteristics and Items

MIL-STD-100G introduces the concept of **Critical Safety Characteristics** and **Critical Safety Items (CSI)**:

- **Critical Safety Characteristic:** Any feature (tolerance, finish, material, process) that, if nonconforming or missing, could cause failure or malfunction of a critical safety item.
- **Critical Safety Item (CSI):** A part, assembly, or system with one or more critical characteristics that, if not conforming to design or quality requirements, would result in an unsafe condition (e.g., loss of control, serious injury, or catastrophic failure)

□ .

- **Documentation:** Drawings must clearly identify CSIs and critical characteristics, and include notes requiring evaluation of any changes or substitutions by the responsible engineering authority.
- **Hardness Critical Items (HCI):** For nuclear survivability, specific notes and controls are required for items and processes critical to nuclear hardness

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IEC 62368-1:2024: Hazard-Based Safety Engineering (HBSE)

IEC 62368-1:2024 is built on the principles of **Hazard-Based Safety Engineering (HBSE)**:

- **Hazard Identification:** The standard requires identification of all potential hazards arising from energy sources, including electrical, thermal, mechanical, chemical, and radiation hazards

□ .

□ **Energy Source Classification:** Energy sources are classified into three levels (Class 1: detectable, Class 2: painful, Class 3: injurious) for each hazard type (e.g., ES1/ES2/ES3 for electrical, TS1/TS2/TS3 for thermal)

□ .

□ **Safeguards:** For each identified hazard, appropriate safeguards (basic, supplementary, reinforced) must be implemented and documented.

□ **Risk Assessment:** A formal risk assessment process is required, documenting the identification of hazards, the effectiveness of safeguards, and the residual risk.

□ **Test Reports:** Comprehensive test reports must document compliance with the standard, including test setups, results, and any deviations or national differences

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Comparative Table: Safety Documentation and Risk Assessment

Dimension	MIL-STD-100G	IEC 62368-1:2024
Safety	Critical safety characteristics and	Hazard-based risk

Dimension	MIL-STD-100G	IEC 62368-1:2024
Focus	items (CSI)	assessment (HBSE)
Documentation	Drawings identify CSIs, critical characteristics, and require evaluation of changes	Documentation of hazards, safeguards, and risk assessments
Change Control	Changes to CSIs require engineering evaluation	Changes affecting safeguards require updated risk assessment
Test Reports	Qualification and acceptance test reports for CSIs	Comprehensive test reports for all hazards and safeguards
Traceability	PINs, CAGE codes, and revision history	Critical component lists, test records, and supplier information

Analysis: MIL-STD-100G’s approach to safety is rooted in the identification and control of critical safety items and characteristics, with rigorous documentation and change control. IEC 62368-1:2024 requires a broader hazard-based risk assessment, with detailed documentation of hazards, safeguards, and residual risks. For ruggedized and safety-critical systems, both approaches are complementary: MIL-STD-100G ensures traceability and control, while IEC 62368-1 ensures comprehensive hazard mitigation.

Qualification Procedures and Testing Requirements

MIL-STD-100G: Qualification for Source Control Drawings

MIL-STD-100G includes detailed qualification provisions, particularly for **source control drawings**:

- **Qualification Process:** Manufacturers must apply for qualification by submitting product samples, test data, and certifications to the design activity identified on the drawing
- .
- **Testing:** Products must be tested to ensure conformance with the drawing requirements, using randomly selected samples from normal production.
- **Retention of Qualification:** Approved sources must periodically (usually every two years) certify continued conformance, manufacturing location, and process stability.

- **Change Notification:** Any change in design, materials, or process after qualification must be reported to the design activity for evaluation.
- **Test Reports:** Detailed test reports and records must be maintained and made available for review.

IEC 62368-1:2024: Testing and Certification

IEC 62368-1:2024 requires comprehensive testing and certification to demonstrate compliance:

- **Product Evaluation:** Products must be evaluated for all relevant hazards, with testing to verify the effectiveness of safeguards.
- **Testing Methods:** Specific tests are defined for insulation, thermal performance, mechanical strength, fire resistance, and more. The latest edition includes updated requirements for batteries, liquid cooling, and wireless power transmitters

□ .

□ **Certification:** Products must be certified by accredited laboratories (e.g., CB Scheme, NRTL, CE marking), with detailed test reports documenting compliance.

□ **Ongoing Compliance:** Manufacturers must monitor changes in the standard and update products and documentation as needed to maintain compliance

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Comparative Table: Qualification and Testing

Dimension	MIL-STD-100G	IEC 62368-1:2024
Qualification Process	Application, testing, and certification by design activity	Product evaluation, testing, and certification by accredited labs
Testing Requirements	Defined by drawing and associated standards	Defined by hazard-based requirements and specific test clauses
Retention of Qualification	Periodic recertification and process audits	Ongoing compliance monitoring and recertification as standards evolve
Change Notification	Mandatory for any change affecting qualified status	Required for any change affecting safety or compliance
Test Reports	Detailed reports for	Comprehensive reports for all

Dimension	MIL-STD-100G	IEC 62368-1:2024
	qualification and acceptance	hazards and safeguards

Analysis: MIL-STD-100G’s qualification procedures are tightly linked to source control drawings and government procurement processes, ensuring that only approved sources and products are used in critical applications. IEC 62368-1:2024 requires a broader, hazard-based approach to testing and certification, with a focus on demonstrating the effectiveness of safeguards. For products subject to both standards, dual compliance may require harmonizing qualification procedures and test documentation.

Intersections for Ruggedized and Safety-Critical Systems

Common Requirements

Ruggedized and safety-critical systems—such as those used in defense, aerospace, industrial automation, and mission-critical communications—must meet stringent requirements for reliability, safety, and documentation. Key intersections between MIL-STD-100G and IEC 62368-1:2024 include:

- **Traceability:** Both standards require traceability of components, assemblies, and changes, ensuring that all parts can be identified and tracked throughout the product lifecycle.
- **Critical Item Identification:** MIL-STD-100G’s CSI concept aligns with IEC 62368-1’s requirement to identify and control hazards associated with critical components and circuits.
- **Documentation:** Comprehensive documentation is required for both engineering data (drawings, lists, revision history) and safety (hazard identification, risk assessment, test reports).
- **Change Management:** Both standards require rigorous change control, with evaluation of the impact on safety, performance, and logistics support.
- **Qualification and Testing:** Products must be qualified and tested to demonstrate conformance with both documentation and safety requirements, with records maintained for traceability and audit.

Unique Considerations

- **Environmental and EMC Requirements:** While MIL-STD-100G references additional standards for environmental and EMC requirements (e.g., MIL-STD-810 for environmental testing, MIL-STD-461 for EMC), IEC 62368-1:2024 includes requirements for EMC,

thermal, mechanical, and environmental hazards within its hazard-based framework

□ .

□ **Supplier and Part Documentation:** MIL-STD-100G requires approved sources and detailed supplier documentation for CSIs, while IEC 62368-1:2024 requires documentation of critical components and supplier certifications for safety-related parts.

□ **Integration with Functional Safety Standards:** IEC 62368-1:2024 is often used in conjunction with functional safety standards such as IEC 61508 and ISO 13849 for systems where programmable electronics perform safety-related functions

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Manufacturing, Supplier, and Part Documentation Requirements

MIL-STD-100G

- **Supplier Approval:** Only approved sources may supply CSIs, with qualification and periodic recertification required.
- **Part Documentation:** Drawings must specify all critical characteristics, materials, processes, and treatments. Supplier documentation must support traceability and conformance.
- **Logistics Support:** Documentation must support government logistics, including spare part availability and configuration management.

IEC 62368-1:2024

- **Critical Component Lists:** Documentation must include lists of all critical components, with supplier information and evidence of compliance with relevant safety standards
- .
- **Test Reports:** Supplier test reports and certifications are required for safety-related parts (e.g., batteries, power supplies, enclosures).
- **Change Control:** Any change in supplier or part must be evaluated for its impact on safety and documented accordingly.

Qualification Records, Test Reports, and Traceability

Both standards require comprehensive records to support traceability, audit, and ongoing compliance:

- **MIL-STD-100G:** Qualification records, test reports, and revision history must be maintained for all CSIs and critical assemblies. Records must be available for government review and audit.
- **IEC 62368-1:2024:** Test reports, risk assessments, and certification records must be maintained and made available to certification bodies and regulatory authorities.

Traceability is achieved through unique identifiers (PINs, CAGE codes, drawing numbers) in MIL-STD-100G, and through critical component lists and test records in IEC 62368-1:2024.

EMC, Thermal, Mechanical, and Environmental Considerations

MIL-STD-100G

- **References to Other Standards:** MIL-STD-100G references additional standards for EMC (MIL-STD-461), environmental testing (MIL-STD-810), and thermal/mechanical requirements. Drawings must specify applicable requirements and test methods.
- **Documentation:** Engineering drawings must include notes and references to applicable environmental and EMC requirements.

IEC 62368-1:2024

- **Hazard-Based Approach:** The standard includes requirements for EMC, thermal, mechanical, and environmental hazards as part of the hazard-based risk assessment.
- **Testing:** Specific tests are defined for insulation, temperature limits, mechanical strength, fire resistance, and EMC immunity. The latest edition includes enhanced requirements for batteries, liquid cooling, and wireless power transmitters
- .

Marking, Labelling, and User Information

MIL-STD-100G

- **Marking Requirements:** Drawings must specify marking requirements for items and packages, including part identification, method of application, and materials, per MIL-STD-130 and MIL-STD-129.
- **Security and Export Control:** Drawings must include security classification and distribution statements as required.

IEC 62368-1:2024

- **Safety Markings:** Products must be marked with warnings, hazard symbols, and user information to ensure safe operation and maintenance.
- **User Instructions:** Comprehensive user and maintenance instructions are required, including warnings about hazardous areas and instructions for safe servicing.

CAD, Digital Data Exchange, and Electronic Deliverables

MIL-STD-100G

- **Digital Data Requirements:** Drawings may be prepared and delivered in digital formats, with requirements for IGES, raster, and SGML files. Physical media must conform to MIL-STD-1840.
- **Electronic Deliverables:** Digital data must provide all required information for the drawing type and level of design disclosure.

IEC 62368-1:2024

- **Electronic Documentation:** While the standard does not prescribe specific file formats, electronic documentation must support traceability, clarity, and compliance with certification requirements.

Tailoring, Contractual Application, and Order of Precedence

MIL-STD-100G

- **Tailoring Guidance:** The standard must be tailored to exclude unnecessary requirements, with contractual applicability defined as

precisely as possible. In case of conflict, the text of MIL-STD-100G takes precedence unless overridden by law or regulation

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IEC 62368-1:2024

- **National Deviations:** The standard allows for national deviations and additional requirements in specific markets (e.g., EN 62368-1 for Europe, UL 62368-1 for North America)
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- **Contractual Application:** Compliance with IEC 62368-1:2024 is often required by contract for products sold internationally, with certification required for market access.

Regulatory and Certification Pathways

MIL-STD-100G

- **U.S. DoD Procurement:** Compliance with MIL-STD-100G is required for DoD procurement, with additional requirements for configuration management, supplier approval, and logistics support.
- **Export Control:** Drawings and data may be subject to export control regulations and distribution statements.

IEC 62368-1:2024

- **CE Marking (Europe):** Compliance with EN 62368-1 is required for CE marking under the Low Voltage Directive (LVD) and EMC Directive. The fourth edition is expected to be harmonized in the EU, with a transition period for adoption

□ .

□ **CB Scheme:** International certification is available through the CB Scheme, with test reports recognized by member countries.

□ **UL/CSA Certification (North America):** Compliance with UL 62368-1 and CSA C22.2 No. 62368-1 is required for the U.S. and Canada, with the fourth edition expected to be enforced from mid-2025

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Change Management and Configuration Control for Safety-Critical Systems

MIL-STD-100G

- **Configuration Management:** MIL-STD-973 and MIL-HDBK-61 provide detailed guidance on configuration management, ensuring that all changes are controlled, reviewed, and approved by the design authority. Configuration management includes baseline establishment, change control, status accounting, and audit
- .
- **Change Control:** All changes affecting CSIs or critical characteristics must be evaluated for their impact on safety, performance, and logistics support.

IEC 62368-1:2024

- **Change Impact Assessment:** Any change affecting a safeguard or critical component requires a new risk assessment and, if necessary, additional testing and certification.
- **Documentation:** All changes must be documented, with updated test reports and risk assessments as needed.

Human Factors, Instructions for Use, and Maintenance Documentation

MIL-STD-100G

- **User and Maintenance Instructions:** Drawings and associated lists must include information necessary for assembly, installation, operation, and maintenance, with references to applicable manuals and procedures.

IEC 62368-1:2024

- **Instructions for Use:** Comprehensive instructions for use and maintenance are required, including warnings, hazard information, and procedures for safe servicing.
- **Human Factors:** The standard requires consideration of user types (ordinary, instructed, skilled) and the accessibility of hazardous energy sources, with safeguards tailored to the expected user.

Component Selection, Substitution, and Approved Item Names

MIL-STD-100G

- **Approved Item Names:** Drawing titles and parts must use approved item names from the Federal Item Name Directory (H6).
- **Component Substitution:** Substitutions for CSIs or critical components require engineering evaluation and approval, with updated documentation and qualification as needed.

IEC 62368-1:2024

- **Critical Component Control:** Substitution of critical components requires evaluation of the impact on safety and, if necessary, additional testing and certification.
- **Supplier Documentation:** Documentation must include evidence of compliance for all critical components.

Integration with Functional Safety Standards

IEC 62368-1:2024 is often used in conjunction with functional safety standards such as **IEC 61508** (functional safety of electronic systems) and **ISO 13849** (safety of machinery). While IEC 62368-1 focuses on basic safety (freedom from unacceptable risk due to physical hazards), functional safety addresses risks arising from programmable electronic safety functions. For products with embedded software or safety-related control systems, compliance with both basic and functional safety standards may be required

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Comparative Table: Key Dimensions and Clauses

Key Dimension	MIL-STD-100G Clause(s)	IEC 62368-1:2024 Clause(s) / Principle	Notes / Intersection Points
Scope & Applicability	1.1, 6.6, 6.2.2	Clause 1, Introduction	MIL-STD-100G for DoD, IEC 62368-1 global
Drawing Practices	100, 200, 300, ASME Y14.100M	Documentation, Safeguard Implementation	MIL-STD-100G prescriptive, IEC 62368-1 performance-

Key Dimension	MIL-STD-100G Clause(s)	IEC 62368-1:2024 Clause(s) / Principle	Notes / Intersection Points
Numbering & Identification	400, 406, 401, 402, 404	Component/Circuit Identification	based Unique IDs in MIL-STD-100G, traceability in IEC 62368-1
Change Control	406.13, 406.14, 406.9, 406.10	Change Impact Assessment, Documentation	Both require rigorous change management
Safety Documentation	3.17, 3.18, 502.1, B50.3	HBSE, Energy Source Classification, Safeguards	CSIs in MIL-STD-100G, hazard-based in IEC 62368-1
Qualification Procedures	Appendix B, B50.3, B50.7	Testing, Certification, Test Reports	Qualification for source control (MIL), certification (IEC)
Marking & Labelling	101.5, 101.5.1, 504, 505, 506	Markings, User Information, Warnings	Both require clear marking and user info
Digital Data & CAD	101.4.2, 101.4.2.5-7	Electronic Documentation	Digital deliverables in both
Configuration Management	MIL-STD-973, MIL-HDBK-61	Change Documentation, Traceability	Formal CM in MIL-STD-100G, impact assessment in IEC 62368-1
EMC, Thermal, Environmental	References to MIL-STD-810, 461	Clauses for EMC, Thermal, Mechanical Hazards	Both address, but via different mechanisms
Human Factors & Instructions	Associated Lists, Drawing Notes	User Types, Instructions for Use	User-focused safeguards in IEC 62368-1
Component Selection	301.1, 406.10, B50.3	Critical Component Control	Both require control and documentation
Functional Safety Integration	N/A	Integration with IEC 61508, ISO 13849	IEC 62368-1 does not cover functional safety, but integration is common

Conclusion and Recommendations

The intersection of **MIL-STD-100G** and **IEC 62368-1:2024** presents both challenges and opportunities for manufacturers and engineers designing

ruggedized or safety-critical electrical and electronic systems. MIL-STD-100G provides a rigorous, structured framework for engineering documentation, change control, and traceability, tailored to the needs of the U.S. Department of Defense and its contractors. IEC 62368-1:2024, on the other hand, offers a modern, hazard-based approach to product safety, applicable to a wide range of commercial and industrial products worldwide.

Key takeaways for practitioners:

- **Integrate Documentation and Safety:** Combine the structured documentation and traceability of MIL-STD-100G with the hazard-based risk assessment and safeguard documentation of IEC 62368-1:2024.
- **Rigorous Change Management:** Ensure that all changes—whether driven by design, supplier, or process—are evaluated for their impact on both traceability (MIL-STD-100G) and safety (IEC 62368-1:2024).
- **Qualification and Certification:** Harmonize qualification procedures for source control drawings (MIL-STD-100G) with the testing and certification requirements of IEC 62368-1:2024, maintaining comprehensive records for both.
- **Critical Item Control:** Identify and control critical safety items and characteristics (MIL-STD-100G) in parallel with hazard identification and safeguard implementation (IEC 62368-1:2024).
- **Stay Current with Standards:** Monitor updates to both standards, as well as related functional safety, EMC, and environmental standards, to ensure ongoing compliance and market access.
- **Tailor for Application:** Tailor the application of both standards to the specific needs of the product, contract, and regulatory environment, ensuring that all necessary requirements are addressed without unnecessary burden.

By synthesizing the requirements of MIL-STD-100G and IEC 62368-1:2024, organizations can achieve robust compliance, enhance product safety, and ensure successful qualification and certification for both military and commercial markets. This integrated approach is especially critical for ruggedized and safety-critical systems, where the consequences of failure are severe and the demands for documentation, traceability, and safety are at their highest.

Appendix: Summary Table—MIL-STD-100G vs. IEC 62368-1:2024

Category	MIL-STD-100G	IEC 62368-1:2024
Applicability	DoD, government-unique, logistics support	Global, commercial, AV/ICT equipment
Drawing Practices	Prescriptive, ASME Y14.100M, detailed formats	Performance-based, documentation of safeguards
Numbering/Identification	Drawing numbers, PINs, CAGE codes	Component/circuit identification, traceability
Change Control	Revision blocks, config management, new PINs	Risk assessment updates, documentation
Safety Documentation	CSIs, critical characteristics, notes on drawings	Hazard-based risk assessment, safeguards
Qualification/Testing	Source control qualification, periodic recert	Product testing, certification, ongoing compliance
Marking/Labelling	MIL-STD-130/129, security/export notes	Safety markings, warnings, user info
Digital Data/CAD	IGES, raster, SGML, MIL-STD-1840	Electronic documentation, format not prescribed
Configuration Management	MIL-STD-973, MIL-HDBK-61	Change documentation, traceability
EMC/Environmental	References to MIL-STD-810/461	Hazard-based clauses for EMC, thermal, mechanical
Human Factors/Instructions	Associated lists, drawing notes	User types, instructions for use, accessibility
Component Selection/Substitution	Approved item names, engineering evaluation	Critical component control, supplier documentation
Functional Safety Integration	Not addressed	Integration with IEC 61508, ISO 13849

In summary, the effective integration of MIL-STD-100G and IEC 62368-1:2024 requirements is essential for organizations designing and documenting ruggedized or safety-critical electrical and electronic systems. By leveraging the strengths of both standards, manufacturers can achieve superior safety, compliance, and market readiness in an increasingly complex regulatory landscape.

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Everything You Need to Know About IEC 62368 and Where Functional Safety ...

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Difference Between IEC 62368 and EN 62368 Standards - Xelite

You said

visual basic code Sales Order QUO-004535.pdf PDF ADA361444-1.pdf PDF
Create a research report on Okay, I've come up with a research plan. It will compare MIL-STD-100G and IEC 62368-1:2024 in the context of compliance, engineering drawing practices, and documentation for ruggedized and

Copilot said

Perfect, Tshingombe — I see where you're heading. You want a **research report** that compares **MIL-STD-100G** (engineering drawing practices for DoD) and **IEC 62368-1:2024** (safety requirements for audio/video, ICT, and electronic equipment), with emphasis on **compliance, ruggedized product design, and documentation routines**. Since you also mentioned Visual Basic code, I'll give you two deliverables:

□ Research Report (Markdown Structured)

Title

Compliance and Engineering Documentation in MIL-STD-100G and IEC 62368-1:2024

1. Scope

- **MIL-STD-100G:** Defines standardized practices for engineering drawings, numbering, coding, and identification in defense contexts.
- **IEC 62368-1:2024:** Hazard-based safety engineering standard for electronic equipment, replacing IEC 60950-1 and IEC 60065.

2. Drawing Practices

Dimension	MIL-STD-100G	IEC 62368-1:2024
Format	ASME Y14.100M aligned; detailed rules for titles, numbering, CAGE codes	No drawing format rules; focuses on safety documentation
Identification	PIN, CAGE, FSCM codes; strict traceability	Product safety labels, hazard warnings
Media	Paper, film, CAD, raster, SGML	Not specified; documentation must support safety compliance

3. Safety Documentation

- **MIL-STD-100G:**
 - Focuses on engineering data, ownership, distribution statements, and security markings.
 - Includes appendices for classification and source control drawings.
- **IEC 62368-1:2024:**
 - Hazard-based safety engineering (HBSE).
 - Requires risk analysis, protective measures, and documentation of compliance with electrical, mechanical, thermal, and fire hazards.
 - Emphasis on consumer product ruggedization (drop, vibration, thermal stress).

4. Qualification Procedures

Aspect	MIL-STD-100G	IEC 62368-1:2024
Qualification	Source control drawings, government/industry approval, DRPRG oversight	Compliance testing by accredited labs; certification marks
Tailoring	DoD allows tailoring to logistics and acquisition needs	IEC allows risk-based tailoring depending on product hazard profile
Audit Evidence	DD Form 1426 proposals, drawing revisions, CAGE traceability	Test reports, CB Scheme certificates, safety case documentation

5. Comparative Analysis

- **Intersection:**
 - Both standards emphasize **traceability and documentation**.
 - MIL-STD-100G ensures **engineering drawing consistency**, while IEC 62368-1 ensures **safety compliance**.
- **Ruggedized Systems:**
 - MIL-STD-100G provides the **drawing and identification backbone**.
 - IEC 62368-1 provides the **hazard-based safety framework**.
- **Best Practice:** Integrate MIL-STD-100G drawing conventions into IEC 62368-1 compliance documentation to ensure both **technical traceability** and **safety certification**.

📄 Visual Basic Code Snippet

Here's a VBA routine to **auto-generate a comparison table** in Excel from uploaded PDF metadata (like your Sales Order and MIL-STD-100G index):

```
vba
Option Explicit

Sub BuildComplianceComparison()
    Dim ws As Worksheet
    Set ws = ThisWorkbook.Sheets("ComplianceReport")
    ws.Cells.Clear

    ' Headers
    ws.Range("A1:D1").Value = Array("Dimension", "MIL-STD-100G", "IEC 62368-1:2024", "Notes")

    ' Populate comparison
    ws.Range("A2:D2").Value = Array("Scope", "Engineering drawing practices", "Hazard-based safety compliance", "")
    ws.Range("A3:D3").Value = Array("Drawing Practices", "ASME Y14.100M, CAGE, PIN", "Safety labels, hazard docs", "")
```



```
ws.Range("A4:D4").Value = Array("Safety Documentation", "Security  
markings, source control", "Risk analysis, protective measures", "")  
ws.Range("A5:D5").Value = Array("Qualification", "Government/industry  
approval", "Accredited lab certification", "")  
  
' Format  
With ws.Range("A1:D5")  
    .Columns.AutoFit  
    .Borders.LineStyle = xlContinuous  
End With
```

Visual Basic quiz engine with logigram and algorithgram

Overview

Below is an audit-ready VBA implementation that:

- Stores quiz items (question, options, correct answer, explanation).

- Presents items via a simple UserForm or Immediate Window fallback.
- Logs responses and generates a mark summary.
- Mirrors your dual-competency theme and standards/compliance content.

It includes:

- A data model (QuizItem, QuizResult).
- Loader functions for your 7-question diagnostic set.
- A controller (RunQuiz) aligned to a logigram (workflow) and an algorigram (decision logic).

Logigram workflow

1. Load questions →
2. Present question →
3. Capture response →
4. Check correctness →
5. Log result →
6. Next question or finish →
7. Compute marks →
8. Export/print summary

Algorigram decision logic

- If QuestionAvailable → Show → GetAnswer
- If Answer = Correct → Score++ → Log "Correct"
- Else → Log "Incorrect" with explanation
- If MoreQuestions → Repeat
- Else → Compute Total → Output Report

VBA modules

1) Data model and loader (Module: modQuiz)

Option Explicit

' Core data structures

Public Type QuizItem

 Id As Long

 Question As String

 Options(1 To 4) As String

 CorrectOptionIndex As Integer

 Explanation As String

End Type

Public Type QuizResult

 ItemId As Long

 SelectedIndex As Integer

 IsCorrect As Boolean

 Timestamp As Date

End Type

' Repository

Private QuizBank() As QuizItem

Private Results() As QuizResult

' Initialize quiz with your questions

Public Sub LoadDiagnosticQuiz()

 Dim i As Long

 ReDim QuizBank(1 To 7)

 ' Q1 – SAQA oversees NQF

 i = 1

 QuizBank(i).Id = i

 QuizBank(i).Question = "Which South African regulatory body oversees the National Qualifications Framework (NQF)?"

 QuizBank(i).Options(1) = "A) DHET"

 QuizBank(i).Options(2) = "B) SAQA"

 QuizBank(i).Options(3) = "C) QCTO"

 QuizBank(i).Options(4) = "D) MERSETA"

 QuizBank(i).CorrectOptionIndex = 2

 QuizBank(i).Explanation = "SAQA manages the NQF, ensuring standardization of qualifications across the country."

 ' Q2 – Systemic issue

 i = 2

 QuizBank(i).Id = i

 QuizBank(i).Question = "What is the main systemic issue documented in South African qualification processes?"

 QuizBank(i).Options(1) = "A) Lack of technical content in curricula"

 QuizBank(i).Options(2) = "B) Excessive reliance on Visual Basic programming"

 QuizBank(i).Options(3) = "C) Certification backlogs and irregularities"

 QuizBank(i).Options(4) = "D) Limited exposure to corporate engagement"

```

QuizBank(i).CorrectOptionIndex = 3
QuizBank(i).Explanation = "Delays, invalidated results, and bureaucratic
failures are major obstacles to qualification."

' Q3 – Schneider EcoStruxure
i = 3
QuizBank(i).Id = i
QuizBank(i).Question = "Which company's EcoStruxure architecture is
referenced for power management?"
QuizBank(i).Options(1) = "A) Eaton"
QuizBank(i).Options(2) = "B) Schneider Electric"
QuizBank(i).Options(3) = "C) Eskom"
QuizBank(i).Options(4) = "D) City Power Johannesburg"
QuizBank(i).CorrectOptionIndex = 2
QuizBank(i).Explanation = "Schneider's EcoStruxure integrates hardware,
software, and analytics for energy management."

' Q4 – Dual competency
i = 4
QuizBank(i).Id = i
QuizBank(i).Question = "What dual competency is required for success in
this environment?"
QuizBank(i).Options(1) = "A) Technical mastery and bureaucratic
resilience"
QuizBank(i).Options(2) = "B) Programming skills and HVAC knowledge"
QuizBank(i).Options(3) = "C) Military compliance and corporate
networking"
QuizBank(i).Options(4) = "D) Mathematics and foreign qualification
evaluation"
QuizBank(i).CorrectOptionIndex = 1
QuizBank(i).Explanation = "Engineers must excel technically while
navigating dysfunctional administrative systems."

' Q5 – MIL-STD-100G
i = 5
QuizBank(i).Id = i
QuizBank(i).Question = "Which MIL-STD defines requirements for
engineering drawings?"
QuizBank(i).Options(1) = "A) MIL-STD-100G"
QuizBank(i).Options(2) = "B) MIL-STD-11991B"
QuizBank(i).Options(3) = "C) IPC 2220"
QuizBank(i).Options(4) = "D) JEDEC JESD625"
QuizBank(i).CorrectOptionIndex = 1
QuizBank(i).Explanation = "MIL-STD-100G sets rules for preparing/revising
engineering drawings."

' Q6 – IPC series
i = 6
QuizBank(i).Id = i
QuizBank(i).Question = "Which IPC series governs high-reliability printed
wiring boards?"
QuizBank(i).Options(1) = "A) IPC 2220 / 6010"
QuizBank(i).Options(2) = "B) ASME Y14.100M"
QuizBank(i).Options(3) = "C) MIL-STD-100G"
QuizBank(i).Options(4) = "D) JEDEC JESD625"

```

```

QuizBank(i).CorrectOptionIndex = 1
QuizBank(i).Explanation = "IPC 2220/6010 standards ensure Class 3
reliability for aerospace/defense PWBs."

' Q7 – Prohibited connectors
i = 7
QuizBank(i).Id = i
QuizBank(i).Question = "Which connector type is prohibited in severe
environments?"
QuizBank(i).Options(1) = "A) Nickel-plated aluminum"
QuizBank(i).Options(2) = "B) Gold-plated copper"
QuizBank(i).Options(3) = "C) Tin-plated brass"
QuizBank(i).Options(4) = "D) Stainless steel"
QuizBank(i).CorrectOptionIndex = 1
QuizBank(i).Explanation = "Nickel-plated aluminum suffers
corrosion/mechanical risks in severe environments."

ReDim Results(1 To UBound(QuizBank))
End Sub

' Controller: run the quiz in Immediate Window (VBE) if no UserForm
Public Sub RunQuiz()
    If (Not IsArrayAllocated(QuizBank)) Then LoadDiagnosticQuiz
    Dim i As Long, sel As Integer, score As Long
    For i = LBound(QuizBank) To UBound(QuizBank)
        PrintQuestion QuizBank(i)
        sel = PromptSelection(QuizBank(i))
        LogResult i, sel, (sel = QuizBank(i).CorrectOptionIndex)
        If sel = QuizBank(i).CorrectOptionIndex Then
            score = score + 1
            Debug.Print "✓ Correct"; vbTab; QuizBank(i).Explanation
        Else
            Debug.Print "✗ Incorrect"; vbTab; QuizBank(i).Explanation
        End If
        Debug.Print String(60, "-")
    Next i
    Debug.Print "Total Score: "; score; " / "; (UBound(QuizBank) -
LBound(QuizBank) + 1)
End Sub

' Helpers
Private Sub PrintQuestion(q As QuizItem)
    Debug.Print "Q" & q.Id & ": " & q.Question
    Debug.Print q.Options(1)
    Debug.Print q.Options(2)
    Debug.Print q.Options(3)
    Debug.Print q.Options(4)
End Sub

Private Function PromptSelection(q As QuizItem) As Integer
    Dim inputStr As String, choice As Integer
    inputStr = InputBox("Enter option number (1-4) for Q" & q.Id, "Quiz")
    If IsNumeric(inputStr) Then
        choice = CInt(inputStr)
        If choice >= 1 And choice <= 4 Then

```

```

        PromptSelection = choice
    Else
        PromptSelection = q.CorrectOptionIndex ' default/fallback
    End If
Else
    PromptSelection = q.CorrectOptionIndex ' fallback
End If
End Function

Private Sub LogResult(ByVal pos As Long, ByVal sel As Integer, ByVal ok As Boolean)
    Results(pos).ItemId = QuizBank(pos).Id
    Results(pos).SelectedIndex = sel
    Results(pos).IsCorrect = ok
    Results(pos).Timestamp = Now
End Sub

Private Function IsArrayAllocated(arr As Variant) As Boolean
    On Error Resume Next
    IsArrayAllocated = (IsArray(arr) And Not IsError(LBound(arr)) And LBound(arr) <= UBound(arr))
End Function

```

2) Optional: UserForm front-end (UserForm: frmQuiz)

Create a UserForm named frmQuiz with:

- Labels: lblQuestion, lblExplanation
- OptionButtons: opt1, opt2, opt3, opt4
- CommandButtons: cmdNext, cmdSubmit

Code-behind:

ption Explicit

```

Private idx As Long
Private score As Long

```

```

Private Sub UserForm_Initialize()
    LoadDiagnosticQuiz
    idx = LBound(QuizBank)
    RenderItem
End Sub

```

```

Private Sub RenderItem()
    Dim q As QuizItem
    q = QuizBank(idx)
    Me.lblQuestion.Caption = "Q" & q.Id & ": " & q.Question
    Me.opt1.Caption = q.Options(1)
    Me.opt2.Caption = q.Options(2)

```

```

        Me.opt3.Caption = q.Options(3)
        Me.opt4.Caption = q.Options(4)
        Me.lblExplanation.Caption = ""
        Me.opt1.Value = False: Me.opt2.Value = False: Me.opt3.Value = False:
Me.opt4.Value = False
End Sub

Private Function SelectedIndex() As Integer
    If Me.opt1.Value Then SelectedIndex = 1
    If Me.opt2.Value Then SelectedIndex = 2
    If Me.opt3.Value Then SelectedIndex = 3
    If Me.opt4.Value Then SelectedIndex = 4
End Function

Private Sub cmdSubmit_Click()
    Dim sel As Integer, ok As Boolean
    sel = SelectedIndex
    If sel = 0 Then
        MsgBox "Please select an option.", vbExclamation
        Exit Sub
    End If
    ok = (sel = QuizBank(idx).CorrectOptionIndex)
    LogResult idx, sel, ok
    If ok Then
        score = score + 1
        Me.lblExplanation.Caption = "✓ " & QuizBank(idx).Explanation
    Else
        Me.lblExplanation.Caption = "✗ " & QuizBank(idx).Explanation
    End If
End Sub

Private Sub cmdNext_Click()
    If idx < UBound(QuizBank) Then
        idx = idx + 1
        RenderItem
    Else
        MsgBox "Quiz complete. Score: " & score & " / " & (UBound(QuizBank) -
LBound(QuizBank) + 1), vbInformation
        Unload Me
    End If
End Sub

```

Export: results and audit trail (Module: modExport)

Option Explicit

```

' Export results to active worksheet for audit-ready traceability
Public Sub ExportResultsToSheet()
    Dim ws As Worksheet, r As Long, i As Long
    Set ws = ActiveSheet
    ws.Range("A1:E1").Value = Array("ItemId", "SelectedIndex", "IsCorrect",
"Timestamp", "Explanation")

```

```

r = 2
For i = LBound(Results) To UBound(Results)
    ws.Cells(r, 1).Value = Results(i).ItemId
    ws.Cells(r, 2).Value = Results(i).SelectedIndex
    ws.Cells(r, 3).Value = Results(i).IsCorrect
    ws.Cells(r, 4).Value = Results(i).Timestamp
    ws.Cells(r, 5).Value = QuizBank(i).Explanation
    r = r + 1
Next i
MsgBox "Export complete: " & (r - 2) & " rows.", vbInformation
End Sub

```

How this maps to your themes

- Technical mastery: standards questions (MIL-STD, IPC), power systems formulas, control components.
- Administrative struggle: SAQA/NQF oversight, systemic backlogs/irregularities.
- Dual competency: explicit question assessing “technical mastery + bureaucratic resilience.”
- Audit-readiness: structured types, export function, explanations tied to each item, reproducibility.

If you want, I can add:

- A VBA “flow painter” that draws the logigram onto a worksheet (boxes/arrows).
- A JSON import/export for questions to maintain versions in GitHub

Visual Basic logigram and algorigram toolkit for clustered notebooks and audit-ready workflows

Overview

Below is a compact, practical toolkit to operationalize your “Options for Moving Forward” using:

- A logigram (process flow) for source clustering and credential management.
- An algorigram (decision logic) for thresholds, rules, and exports.

- VBA code modules for data models, clustering, dashboards, and audit trails.
- Templates for audit-ready checklists, competency matrices, and DLT-ready credential entries.

Logigram: End-to-end workflow

1. Ingest sources →
2. Classify into clusters (Standards, Compliance, Corporate) →
3. Normalize records (title, author, tags, dates) →
4. Apply rules (thresholds, unit standards mapping, RPL linkage) →
5. Generate competency matrices and audit checklists →
6. Issue credential artifacts (CSV/PDF entries, DLT hash anchor optional) →
7. Export dashboards and summaries →
8. Archive to repositories

Algorigram: Core decision logic

- IF source.count > cap THEN split into thematic clusters
- FOR each source:
 - Tag domain, framework, standard
 - IF unit standard exists → map to competency matrix
 - IF evidence completeness < threshold → flag for remediation
- IF cluster ready → build dashboard and export
- IF credential artifact validated → write to registry and archive

VBA modules

1) Data model and clustering (Module: modModel)

Option Explicit

Public Enum ClusterType

 ctStandards = 1 ' MIL-STD, IPC, JEDEC, ASME, NIJ
 ctCompliance = 2 ' SAQA, DHET, QCTO, NQF, Umalusi, SETAs
 ctCorporate = 3 ' Eskom, City Power, Schneider, Eaton, SARS, Defence
 ctProjects = 4 ' Labs, PoE artifacts, ICASS/ISAT, RPL evidence

End Enum

Public Type SourceItem

 Id As Long
 Title As String
 Author As String
 Tags As String ' comma-separated tags
 DateStamp As Date
 UrlOrPath As String
 Cluster As ClusterType

End Type

Public Type CredentialEntry

 DateStamp As Date
 Institution As String
 ModuleOrUnit As String
 SalePrice As Currency
 Amendment As Currency
 FinalCost As Currency
 Award As String
 StandardsTag As String ' e.g., "MIL-STD-202 Method 204; BS 7671"
 RepoLink As String ' e.g., GitHub, Archive ref

End Type

Public Sources() As SourceItem

Public Credentials() As CredentialEntry

Public Sub InitSources(ByVal n As Long)

 ReDim Sources(1 To n)

End Sub

Public Sub InitCredentials(ByVal n As Long)

 ReDim Credentials(1 To n)

End Sub

Public Function AssignCluster(ByVal title As String, ByVal tags As String) As ClusterType

 Dim t As String: t = LCase\$(title & " " & tags)
 If InStr(t, "mil-std") Or InStr(t, "ipc") Or InStr(t, "nij") Or InStr(t, "asme") Then
 AssignCluster = ctStandards
 ElseIf InStr(t, "saqa") Or InStr(t, "dheth") Or InStr(t, "nqf") Or InStr(t, "qcto") Or InStr(t, "umalusi") Then
 AssignCluster = ctCompliance
 ElseIf InStr(t, "eskom") Or InStr(t, "schneider") Or InStr(t, "eaton") Or InStr(t, "city power") Or InStr(t, "sars") Then
 AssignCluster = ctCorporate
 Else

```

        AssignCluster = ctProjects
    End If
End Function

```

2) Rules engine and metrics (Module: modRules)

```
Option Explicit
```

```

Public Type EvidenceScore
    Completeness As Double ' 0..1
    Traceability As Double ' 0..1
    StandardsAlignment As Double ' 0..1
    Overall As Double
End Type

```

```

Public Function CalculateFinalCost(ByVal salePrice As Currency, ByVal
amendment As Currency) As Currency
    CalculateFinalCost = salePrice + amendment
End Function

```

```

Public Function BalanceAmendmentsVsFinal(ByRef creds() As CredentialEntry) As
Currency
    Dim i As Long, B As Currency
    For i = LBound(creds) To UBound(creds)
        B = B + (creds(i).SalePrice + creds(i).Amendment -
creds(i).FinalCost)
    Next i
    BalanceAmendmentsVsFinal = B
End Function

```

```

Public Function ScoreEvidence(ByVal hasPhotos As Boolean, ByVal
hasMeasurements As Boolean, _ ByVal hasStandardsRef As Boolean, ByVal
hasSignatures As Boolean) As EvidenceScore
    Dim s As EvidenceScore, c As Double, tr As Double, st As Double
    c = IIf(hasPhotos And hasMeasurements And hasSignatures, 1, 0.6)
    tr = IIf(hasSignatures, 1, 0.5)
    st = IIf(hasStandardsRef, 1, 0.5)
    s.Completeness = c
    s.Traceability = tr
    s.StandardsAlignment = st
    s.Overall = (c + tr + st) / 3#
    ScoreEvidence = s
End Function

```

3) Dashboard and export (Module: modDashboard)

```
Option Explicit
```

```

Public Sub ExportClustersToSheet()
    Dim ws As Worksheet, r As Long, i As Long
    Set ws = ActiveSheet
    ws.Cells.Clear

```

```

        ws.Range("A1:H1").Value = Array("Id", "Title", "Author", "Tags",
"DateStamp", "Path", "Cluster", "StandardsTag")
        r = 2
        For i = LBound(Sources) To UBound(Sources)
            ws.Cells(r, 1).Value = Sources(i).Id
            ws.Cells(r, 2).Value = Sources(i).Title
            ws.Cells(r, 3).Value = Sources(i).Author
            ws.Cells(r, 4).Value = Sources(i).Tags
            ws.Cells(r, 5).Value = Sources(i).DateStamp
            ws.Cells(r, 6).Value = Sources(i).UrlOrPath
            ws.Cells(r, 7).Value = ClusterName(Sources(i).Cluster)
            ws.Cells(r, 8).Value = ExtractStandardsTag(Sources(i).Tags)
            r = r + 1
        Next i
        ws.Columns.AutoFit
        MsgBox "Exported " & (r - 2) & " sources by cluster.", vbInformation
    End Sub

    Public Function ClusterName(ByVal c As ClusterType) As String
        Select Case c
            Case ctStandards: ClusterName = "Standards & Technical Mastery"
            Case ctCompliance: ClusterName = "Educational Compliance (SAQA/DHET)"
            Case ctCorporate: ClusterName = "Corporate & Public Sector
Engagement"
            Case ctProjects: ClusterName = "Projects & PoE"
        End Select
    End Function

    Public Function ExtractStandardsTag(ByVal tags As String) As String
        Dim t As String: t = LCase$(tags)
        If InStr(t, "mil-std") Then ExtractStandardsTag = "MIL-STD"
        If InStr(t, "ipc") Then ExtractStandardsTag = Trim$(ExtractStandardsTag &
" IPC")
        If InStr(t, "bs 7671") Then ExtractStandardsTag = Trim$(
ExtractStandardsTag & " BS 7671")
        If InStr(t, "nij") Then ExtractStandardsTag = Trim$(ExtractStandardsTag &
" NIJ")
    End Function

    Public Sub ExportCredentialsToSheet()
        Dim ws As Worksheet, r As Long, i As Long, B As Currency
        Set ws = ActiveSheet
        ws.Cells.Clear
        ws.Range("A1:I1").Value = Array("Date", "Institution", "Module/Unit",
"SalePrice", "Amendment", "FinalCost", "Award", "StandardsTag", "RepoLink")
        r = 2
        For i = LBound(Credentials) To UBound(Credentials)
            ws.Cells(r, 1).Value = Credentials(i).DateStamp
            ws.Cells(r, 2).Value = Credentials(i).Institution
            ws.Cells(r, 3).Value = Credentials(i).ModuleOrUnit
            ws.Cells(r, 4).Value = Credentials(i).SalePrice
            ws.Cells(r, 5).Value = Credentials(i).Amendment
            ws.Cells(r, 6).Value = Credentials(i).FinalCost
            ws.Cells(r, 7).Value = Credentials(i).Award
            ws.Cells(r, 8).Value = Credentials(i).StandardsTag

```

```

        ws.Cells(r, 9).Value = Credentials(i).RepoLink
        r = r + 1
    Next i
    B = BalanceAmendmentsVsFinal(Credentials)
    ws.Cells(r + 1, 1).Value = "Balance Amendments vs Final Cost:"
    ws.Cells(r + 1, 2).Value = B
    ws.Columns.AutoFit
    MsgBox "Exported " & (r - 2) & " credential entries. Balance = " &
FormatCurrency(B), vbInformation
End Sub

```

4) Controller and flow painter (Module: modController)

Option Explicit

```

Public Sub BuildDemoData()
    Dim i As Long
    InitSources 6
    ' Demo sources
    For i = 1 To 6
        Sources(i).Id = i
    Next i
    Sources(1).Title = "MIL-STD-100G Drawing Rules": Sources(1).Tags = "MIL-STD, ASME"
    Sources(2).Title = "IPC-6010 Class 3 Fabrication": Sources(2).Tags = "IPC"
    Sources(3).Title = "SAQA NQF Compliance Brief": Sources(3).Tags = "SAQA, NQF, DHET"
    Sources(4).Title = "Umalusi Backlog Mitigation": Sources(4).Tags = "Umalusi, Certification"
    Sources(5).Title = "Schneider EcoStruxure Case": Sources(5).Tags = "Schneider, Corporate"
    Sources(6).Title = "PoE: IR Dimmer (PIC/TRIAC)": Sources(6).Tags = "BS 7671, Project, Lab"

    For i = 1 To 6
        Sources(i).Cluster = AssignCluster(Sources(i).Title, Sources(i).Tags)
        Sources(i).Author = "Tshingombe"
        Sources(i).DateStamp = Date
        Sources(i).UrlOrPath = "repo://" & Sources(i).Title
    Next i

    InitCredentials 3
    Credentials(1).DateStamp = Date: Credentials(1).Institution = "DHET/TVET"
    Credentials(1).ModuleOrUnit = "Electrical Trade Theory N4"
    Credentials(1).SalePrice = 500: Credentials(1).Amendment = -100
    Credentials(1).FinalCost = CalculateFinalCost(Credentials(1).SalePrice,
Credentials(1).Amendment)
    Credentials(1).Award = "Module Pass": Credentials(1).StandardsTag = "NATED"
    Credentials(1).RepoLink = "github://credential/001"

    Credentials(2).DateStamp = Date: Credentials(2).Institution = "SQA"
    Credentials(2).ModuleOrUnit = "Graded Unit 1 (Exam)"

```

```

    Credentials(2).SalePrice = 0: Credentials(2).Amendment = 0
    Credentials(2).FinalCost = 0: Credentials(2).Award = "HNC Credit"
    Credentials(2).StandardsTag = "SCQF7": Credentials(2).RepoLink =
"github://credential/002"

    Credentials(3).DateStamp = Date: Credentials(3).Institution = "Vendor"
    Credentials(3).ModuleOrUnit = "Schneider EcoStruxure Micro-Cert"
    Credentials(3).SalePrice = 1200: Credentials(3).Amendment = -400
    Credentials(3).FinalCost = CalculateFinalCost(Credentials(3).SalePrice,
Credentials(3).Amendment)
    Credentials(3).Award = "Contributor Badge"
    Credentials(3).StandardsTag = "IEC/SANS": Credentials(3).RepoLink =
"archive://credential/003"
End Sub

Public Sub RunWorkflow()
    BuildDemoData
    ExportClustersToSheet
    ExportCredentialsToSheet
    DrawLogigram ActiveSheet, 12, 2
End Sub

' Simple flow painter: draws boxes and arrows on worksheet
Public Sub DrawLogigram(ws As Worksheet, ByVal topRow As Long, ByVal leftCol
As Long)
    Dim s As Shape, x As Double, y As Double, w As Double, h As Double
    w = 220: h = 36: x = ws.Cells(topRow, leftCol).Left: y = ws.Cells(topRow,
leftCol).Top
    Dim stepsArr As Variant
    stepsArr = Array("Ingest sources", "Classify clusters", "Normalize
records", "Apply rules",
                    "Build matrices & checklists", "Issue credential
artifacts", "Export dashboards", "Archive")
    Dim i As Long
    For i = LBound(stepsArr) To UBound(stepsArr)
        Set s = ws.Shapes.AddShape(msoShapeRoundedRectangle, x, y + i * (h +
10), w, h)
        s.TextFrame2.TextRange.Text = stepsArr(i)
        s.Fill.ForeColor.RGB = RGB(232, 244, 254)
        s.Line.ForeColor.RGB = RGB(80, 120, 200)
        If i > LBound(stepsArr) Then
            Dim a As Shape
            Set a = ws.Shapes.AddConnector(msoConnectorStraight, x + w / 2, y
+ (i - 1) * (h + 10) + h, x + w / 2, y + i * (h + 10))
            a.Line.ForeColor.RGB = RGB(80, 120, 200)
        End If
    Next i
End Sub

```

Audit-ready checklist template

- **Asset ID:**

- **Serial:**
- **Standard applied:**
- **Test method & parameters:**
- **Result (pass/fail):**
- **Signatures (assessor/moderator):**
- **Evidence links (repo/archive):**
- **Date/time:**
- **Notes/observations:**

Competency matrix (NATED/NCV mapping)

- **Module:** Diodes / Drives / UPS / Power syste

Option Explicit

```
' === Draw NAND Truth Table ===
Public Sub DrawNANDTruthTable()
    Dim ws As Worksheet
    Set ws = ActiveSheet

    ws.Range("A1:C1").Value = Array("Input A", "Input B", "Output")

    Dim inputsA As Variant, inputsB As Variant, i As Integer
    inputsA = Array(0, 0, 1, 1)
    inputsB = Array(0, 1, 0, 1)

    For i = 0 To 3
        ws.Cells(i + 2, 1).Value = inputsA(i)
        ws.Cells(i + 2, 2).Value = inputsB(i)
        ws.Cells(i + 2, 3).Value = NAND(inputsA(i), inputsB(i))
    Next i
End Sub

Private Function NAND(a As Integer, b As Integer) As Integer
    ' NAND gate: output is NOT (A AND B)
    If a = 1 And b = 1 Then
        NAND = 0
    Else
        NAND = 1
    End If
End Function

' === Transformer Turns Ratio ===
```

```

Public Sub TransformerTurnsRatio()
    Dim Np As Double, Ns As Double, Vp As Double, Vs As Double
    Np = 200: Ns = 100    ' Example turns
    Vp = 240              ' Example primary voltage

    Vs = Vp * (Ns / Np)

    MsgBox "Transformer Turns Ratio Principle:" & vbCrLf & _
        "Vp/Vs = Np/Ns" & vbCrLf & _
        "Primary Voltage = " & Vp & " V" & vbCrLf & _
        "Secondary Voltage = " & Vs & " V"
End Sub

' === Inductor Current Calculation ===
Public Sub InductorCurrent()
    Dim L As Double, t As Double, Vt As Double, It As Double

    L = 2 ' Henries
    t = 0.01 ' Example time in seconds

    ' V(t) = 10 * sin(100t)
    Vt = 10 * Sin(100 * t)

    ' I(t) = (1/L) ∫ V(t) dt
    ' Analytical solution: I(t) = -0.05 * Cos(100t)
    It = -0.05 * Cos(100 * t)

    MsgBox "At time t=" & t & " s:" & vbCrLf & _
        "V(t) = " & Round(Vt, 3) & " V" & vbCrLf & _
        "I(t) = " & Round(It, 3) & " A"
End Sub

' === Export Exam Questions and Answers ===
Public Sub ExportExam()
    Dim ws As Worksheet
    Set ws = ActiveSheet
    ws.Cells.Clear

    Dim row As Integer
    row = 1

    ws.Cells(row, 1).Value = "Exam Assessment: Electrical Engineering Curriculum Framework"
    row = row + 2

    ws.Cells(row, 1).Value = "Q5: NAND Gate Truth Table"
    ws.Cells(row + 1, 1).Value = "Answer: See table generated by DrawNANDTruthTable()"
    ws.Cells(row + 2, 1).Value = "Marks: 8"
    row = row + 4

    ws.Cells(row, 1).Value = "Q6: Transformer Turns Ratio Principle"
    ws.Cells(row + 1, 1).Value = "Answer: Vp/Vs = Np/Ns"
    ws.Cells(row + 2, 1).Value = "Marks: 5"
    row = row + 4

```



```

ws.Cells(row, 1).Value = "Q7: Inductor Current for V(t)=10sin(100t)"
ws.Cells(row + 1, 1).Value = "Answer: I(t) = -0.05 cos(100t) A"
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

ws.Cells(row, 1).Value = "Q8: Open vs Closed Loop Control"
ws.Cells(row + 1, 1).Value = "Answer: Open-loop has no feedback; closed-
loop uses feedback for accuracy."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

ws.Cells(row, 1).Value = "Q9: Protective Devices"
ws.Cells(row + 1, 1).Value = "Answer: Relays and Circuit Breakers"
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

ws.Cells(row, 1).Value = "Q10: Capacitor Energy"
ws.Cells(row + 1, 1).Value = "Answer: W = 1/2 C V^2"
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

ws.Cells(row, 1).Value = "Q11: Faraday's Law"
ws.Cells(row + 1, 1).Value = "Answer: E = - dΦ/dt"
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

ws.Cells(row, 1).Value = "Total Marks: 67 (scaled to 100)"
End Sub

```

How this works

- **DrawNANDTruthTable:** Builds the NAND truth table in Excel.
- **TransformerTurnsRatio:** Demonstrates the principle $V_p V_s = N_p N_s \frac{V_p}{N_p} = \frac{V_s}{N_s}$.
- **InductorCurrent:** Evaluates $I(t) = -0.05 \cos(100t)$ at a sample time.
- **ExportExam:** Outputs your exam questions, answers, and marks into a worksheet for moderation and audit.

Visual Basic toolkit: Export exam, draw AND truth table, and compute engineering answers

What this does

- Writes your Section B/C/D questions, answers, and marks to an Excel worksheet.
- Draws the AND gate truth table in cells.
- Computes transformer secondary voltage (Q8), inductor current solution sampling (Q13), and energy over one cycle for $P(t)=100\sin^2(t)$ (Q20).
- Totals section marks and shows the 120-mark paper scaled to 100.

VBA code

Option Explicit

```
' ===== Utility math helpers =====
Private Function PiVal() As Double
    PiVal = WorksheetFunction.Pi()
End Function

' Transformer secondary voltage: Vs = Vp * (Ns/Np)
Public Function TransformerVs(ByVal Vp As Double, ByVal Np As Double, ByVal
Ns As Double) As Double
    TransformerVs = Vp * (Ns / Np)
End Function

' Inductor current for V(t) = Vm * sin(ω t), L = inductance
' Analytic: I(t) = -(Vm/(ω L)) * cos(ω t) + C ; assume C=0 for zero DC offset
Public Function InductorI(ByVal Vm As Double, ByVal omega As Double, ByVal L
As Double, ByVal t As Double) As Double
    InductorI = -(Vm / (omega * L)) * Cos(omega * t)
End Function

' Energy over one cycle for P(t) = A * sin^2(t) on [0, 2π]: E = A * π
Public Function EnergyOverOneCycleSin2(ByVal A As Double) As Double
    EnergyOverOneCycleSin2 = A * PiVal()
End Function

' ===== Logic truth tables =====
' AND Gate truth table in cells A..C
Public Sub DrawANDTruthTable(Optional ByVal startRow As Long = 2, Optional
ByVal startCol As Long = 1)
    Dim ws As Worksheet
    Set ws = ActiveSheet

    ws.Cells(startRow, startCol).Resize(1, 3).Value = Array("A", "B",
"Output")
    ws.Cells(startRow + 1, startCol).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 0, 1, 1))
    ws.Cells(startRow + 1, startCol + 1).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 1, 0, 1))
```

```

    Dim r As Long
    For r = startRow + 1 To startRow + 4
        ws.Cells(r, startCol + 2).Value = ANDGate(ws.Cells(r,
startCol).Value, ws.Cells(r, startCol + 1).Value)
    Next r

    ws.Columns(startCol).Resize(, 3).AutoFit
End Sub

Private Function ANDGate(a As Integer, b As Integer) As Integer
    ANDGate = IIf(a = 1 And b = 1, 1, 0)
End Function

' ===== Section exports =====
Public Sub ExportExamSections()
    Dim ws As Worksheet, row As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
    row = 1

    ' Header and structure
    ws.Cells(row, 1).Value = "Electrical & Industrial Engineering – Exam
Assessment"
    row = row + 2
    ws.Cells(row, 1).Value = "Exam Structure: Section A 30, Section B 35,
Section C 35, Section D 20 | Total 120 (scaled to 100)"
    row = row + 2

    ' ---- Section B: Intermediate Electrical Engineering (35 marks) ----
    ws.Cells(row, 1).Value = "Section B: Intermediate Electrical Engineering
(N4–N5) – 35 Marks"
    row = row + 2

    ' Q7 Resonance
    ws.Cells(row, 1).Value = "Q7. Explain resonance in AC circuits."
    ws.Cells(row + 1, 1).Value = "Answer: Resonance occurs when  $X_L = X_C$ ,
yielding maximum current at the resonant frequency."
    ws.Cells(row + 2, 1).Value = "Marks: 6"
    row = row + 4

    ' Q8 Transformer calculation
    Dim Vs As Double
    Vs = TransformerVs(240, 200, 50)
    ws.Cells(row, 1).Value = "Q8. Transformer turns ratio:  $N_p=200$ ,  $N_s=50$ ,
 $V_p=240$  V. Calculate  $V_s$ ."
    ws.Cells(row + 1, 1).Value = "Answer:  $V_s = V_p * (N_s/N_p) = 240 * (50/200)$ 
= " & Format(Vs, "0") & " V"
    ws.Cells(row + 2, 1).Value = "Marks: 6"
    row = row + 4

    ' Q9 AND truth table
    ws.Cells(row, 1).Value = "Q9. Draw the truth table for an AND gate."
    ws.Cells(row + 1, 1).Value = "Answer: Table inserted below."
    ws.Cells(row + 2, 1).Value = "Marks: 6"
    DrawANDTruthTable row + 3, 1

```

```

row = row + 9

' Q10 Boolean simplification  $A \cdot B + A \cdot \bar{B} = A$ 
ws.Cells(row, 1).Value = "Q10. Simplify:  $A \cdot B + A \cdot \bar{B}$ "
ws.Cells(row + 1, 1).Value = "Answer: A (by factoring A and using  $B + \bar{B} = 1$ )."
```

1).

```

ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' Q11 Binary to decimal 1011
ws.Cells(row, 1).Value = "Q11. Convert binary 1011 to decimal."
ws.Cells(row + 1, 1).Value = "Answer: 11 ( $8 + 0 + 2 + 1$ )."
```

1).

```

ws.Cells(row + 2, 1).Value = "Marks: 4"
row = row + 4

' Q12 Rectifier vs filter
ws.Cells(row, 1).Value = "Q12. State one function of a rectifier and one
of a filter."
ws.Cells(row + 1, 1).Value = "Answer: Rectifier converts AC to DC; Filter
smooths DC by reducing ripple."
ws.Cells(row + 2, 1).Value = "Marks: 4"
row = row + 4

' ---- Section C: Advanced Electrical Engineering (35 marks) ----
ws.Cells(row, 1).Value = "Section C: Advanced Electrical Engineering
(N6/Diploma) – 35 Marks"
row = row + 2

' Q13 Inductor current for  $V(t)=20 \sin(50 t)$ ,  $L=5 \text{ H}$ 
Dim It As Double, t As Double
t = 0.01 ' sample time [s]
It = InductorI(20, 50, 5, t) '  $I(t) = -(20/(50 \cdot 5)) \cos(50 t) = -0.08$ 
cos(50 t)
ws.Cells(row, 1).Value = "Q13. Solve current for  $V(t)=20 \sin(50 t)$  across
 $L=5 \text{ H}$ ."
ws.Cells(row + 1, 1).Value = "Answer:  $I(t) = -0.08 \cos(50 t) \text{ A}$ . Sample at
t=" & t & " s:  $I(t)=$  " & Format(It, "0.000") & " A."
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

' Q14 Open-loop vs closed-loop
ws.Cells(row, 1).Value = "Q14. Differentiate open-loop and closed-loop
control systems."
ws.Cells(row + 1, 1).Value = "Answer: Open-loop has no feedback; closed-
loop uses feedback to adjust input, improving accuracy/stability."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' Q15 Protective devices
ws.Cells(row, 1).Value = "Q15. Name two protective devices and their
functions."
ws.Cells(row + 1, 1).Value = "Answer: Relay detects abnormal conditions
and trips; Circuit breaker interrupts fault current."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

```

```

' Q16 Transducers role
ws.Cells(row, 1).Value = "Q16. Role of transducers in automation."
ws.Cells(row + 1, 1).Value = "Answer: Convert physical quantities to
electrical signals for monitoring and control."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' Q17 High-level engineering software outcome
ws.Cells(row, 1).Value = "Q17. Learning outcome of high-level engineering
software."
ws.Cells(row + 1, 1).Value = "Answer: Ability to write, test, and
document I/O control programs with loops and subroutines."
ws.Cells(row + 2, 1).Value = "Marks: 7"
row = row + 4

' ---- Section D: Integration of Advanced Mathematics (20 marks) ----
ws.Cells(row, 1).Value = "Section D: Integration of Advanced Mathematics
- 20 Marks"
row = row + 2

' Q18 Capacitor energy
ws.Cells(row, 1).Value = "Q18. Energy stored in a capacitor."
ws.Cells(row + 1, 1).Value = "Answer:  $W = \frac{1}{2} C V^2$ ; energy in the
electric field."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' Q19 Faraday's Law
ws.Cells(row, 1).Value = "Q19. Faraday's Law of Induction."
ws.Cells(row + 1, 1).Value = "Answer:  $E = - \frac{d\Phi}{dt}$ ."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' Q20 Energy over one cycle for  $P(t) = 100 \sin^2(t)$ 
Dim Ecycle As Double
Ecycle = EnergyOverOneCycleSin2(100)
ws.Cells(row, 1).Value = "Q20. Energy over one cycle for  $P(t)=100$ 
 $\sin^2(t)$ ."
ws.Cells(row + 1, 1).Value = "Answer:  $E = 100 \pi \approx$ " & Format(Ecycle,
"0.000") & " J."
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

' ---- Totals and scaling ----
ws.Cells(row, 1).Value = "Totals:"
ws.Cells(row + 1, 1).Value = "Section A: 30 marks"
ws.Cells(row + 2, 1).Value = "Section B: 35 marks"
ws.Cells(row + 3, 1).Value = "Section C: 35 marks"
ws.Cells(row + 4, 1).Value = "Section D: 20 marks"
ws.Cells(row + 5, 1).Value = "Total: 120 marks (scaled to 100 for final
grading)"
ws.Columns(1).EntireColumn.AutoFit

```

```
MsgBox "Exam export complete. AND truth table inserted; calculations  
computed.", vbInformation  
End Sub
```

How to use

1. Open Excel, press Alt+F11, insert a new Module, and paste the code.
2. In Excel, select a blank sheet.
3. Run ExportExamSections to generate the full paper and computed answers.
4. The AND truth table appears under Q9; transformer, inductor, and energy computations are embedded.

If you want, I can add:

- A marking-rubric sheet with criteria weights and automatic scaling to 100.
- A candidate response form and auto-marking macro for MCQs and numeric answers.
- A logigram painter that draws the exam workflow on the sheet for moderation recor

Visual Basic toolkit: export exam, compute rectifier output, transformer voltage, and draw NAND truth table

Overview

- Exports your Sections A-E questions, answers, and marks to an Excel sheet.
- Computes average DC output of a full-wave rectifier.
- Calculates transformer secondary voltage.
- Draws the NAND gate truth table.
- Totals marks and notes scaling to 100.

VBA code

tion Explicit

```
' ===== Math/EE helpers =====

' Full-wave rectifier average DC output:  $V_{dc} = (2 * V_{peak}) / \pi$ 
Public Function RectifierVdc(ByVal Vpeak As Double) As Double
    RectifierVdc = (2# * Vpeak) / WorksheetFunction.Pi()
End Function

' Transformer secondary voltage:  $V_s = V_p * (N_s / N_p)$ 
Public Function TransformerVs(ByVal Vp As Double, ByVal Np As Double, ByVal
Ns As Double) As Double
    TransformerVs = Vp * (Ns / Np)
End Function

' ===== Logic helpers =====

' NAND gate output: NOT (A AND B)
Private Function NANDGate(ByVal a As Integer, ByVal b As Integer) As Integer
    If a = 1 And b = 1 Then
        NANDGate = 0
    Else
        NANDGate = 1
    End If
End Function

' Draw NAND truth table starting at given cell
Public Sub DrawNANDTruthTable(Optional ByVal startRow As Long = 2, Optional
ByVal startCol As Long = 1)
    Dim ws As Worksheet: Set ws = ActiveSheet
    ws.Cells(startRow, startCol).Resize(1, 3).Value = Array("A", "B",
"Output")

    ' Inputs
    ws.Cells(startRow + 1, startCol).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 0, 1, 1))
    ws.Cells(startRow + 1, startCol + 1).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 1, 0, 1))

    ' Outputs
    Dim r As Long
    For r = startRow + 1 To startRow + 4
        ws.Cells(r, startCol + 2).Value = NANDGate(ws.Cells(r,
startCol).Value, ws.Cells(r, startCol + 1).Value)
    Next r

    ws.Columns(startCol).Resize(, 3).AutoFit
End Sub

' ===== Exam export =====

Public Sub ExportExam_Electrical()
    Dim ws As Worksheet, row As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
```

```

row = 1

' Header
ws.Cells(row, 1).Value = "Electrical & Industrial Engineering – Exam
Assessment"
row = row + 2
ws.Cells(row, 1).Value = "Exam Structure: Section A 25 | Section B 25 |
Section C 20 | Section D 20 | Section E 20 | Total 110 (scaled to 100)"
row = row + 2

' ===== Section B: Power Supplies (subset shown in prompt) =====
ws.Cells(row, 1).Value = "Section B: Power Supplies – 25 Marks"
row = row + 2

' Q6 Rectifier average DC
Dim Vdc As Double
Vdc = RectifierVdc(20) ' Vpeak = 20 V
ws.Cells(row, 1).Value = "Q6. Average DC output of a full-wave rectifier,
Vpeak = 20 V."
ws.Cells(row + 1, 1).Value = "Answer: VDC = (2 * Vpeak) / π = 40/π ≈ " &
Format(Vdc, "0.00") & " V"
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

' Q7 Capacitor filter function
ws.Cells(row, 1).Value = "Q7. State one function of a capacitor filter in
a power supply."
ws.Cells(row + 1, 1).Value = "Answer: Smooths the rectified DC output by
reducing ripple voltage."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' Q8 Amplifier application
ws.Cells(row, 1).Value = "Q8. Name one practical application of
amplifiers."
ws.Cells(row + 1, 1).Value = "Answer: Signal amplification in audio
equipment."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' ===== Section C: Transformers – 20 Marks =====
ws.Cells(row, 1).Value = "Section C: Transformers – 20 Marks"
row = row + 2

' Q9 Principle of transformer action
ws.Cells(row, 1).Value = "Q9. Explain the principle of transformer
action."
ws.Cells(row + 1, 1).Value = "Answer: Mutual inductance—changing primary
current induces secondary voltage."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' Q10 Transformer calculation
Dim Vs As Double
Vs = TransformerVs(240, 400, 100) ' Vp=240, Np=400, Ns=100

```



```

ws.Cells(row, 1).Value = "Q10. Transformer: Np=400, Ns=100, Vp=240 V.
Calculate Vs."
ws.Cells(row + 1, 1).Value = "Answer:  $V_s = V_p * (N_s/N_p) = 240 * (100/400)$ 
= " & Format(Vs, "0") & " V"
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

' Q11 Transformer application
ws.Cells(row, 1).Value = "Q11. State one practical application of
transformers in industry."
ws.Cells(row + 1, 1).Value = "Answer: Voltage step-down for safe
distribution in factories."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' ===== Section D: Digital Systems – 20 Marks =====
ws.Cells(row, 1).Value = "Section D: Digital Systems – Binary Logic &
Boolean Algebra – 20 Marks"
row = row + 2

' Q12 NAND truth table
ws.Cells(row, 1).Value = "Q12. Construct the truth table for a NAND
gate."
ws.Cells(row + 1, 1).Value = "Answer: Table inserted below."
ws.Cells(row + 2, 1).Value = "Marks: 8"
DrawNANDTruthTable row + 3, 1
row = row + 9

' Q13 Boolean simplification
ws.Cells(row, 1).Value = "Q13. Simplify the Boolean expression:  $A \cdot B + A \cdot \bar{B}$ "
ws.Cells(row + 1, 1).Value = "Answer: A (factor A; use  $B + \bar{B} = 1$ ). "
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' Q14 Binary to decimal
ws.Cells(row, 1).Value = "Q14. Convert binary 1011 to decimal."
ws.Cells(row + 1, 1).Value = "Answer: 11 ( $8 + 0 + 2 + 1$ ). "
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' ===== Section E: Control Systems & Transducers – 20 Marks =====
ws.Cells(row, 1).Value = "Section E: Control Systems & Transducers – 20
Marks"
row = row + 2

' Q15 Open vs closed loop
ws.Cells(row, 1).Value = "Q15. Differentiate between open-loop and
closed-loop control systems."
ws.Cells(row + 1, 1).Value = "Answer: Open-loop operates without
feedback; closed-loop uses feedback to adjust input."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' Q16 Role of transducers

```

```

ws.Cells(row, 1).Value = "Q16. State one role of transducers in automated systems."
ws.Cells(row + 1, 1).Value = "Answer: Convert physical quantities to electrical signals for monitoring/control."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' Q17 Practical lab tasks
ws.Cells(row, 1).Value = "Q17. Name two practical tasks learners may perform to demonstrate control competence."
ws.Cells(row + 1, 1).Value = "Answer: (1) Wiring a control panel. (2) Calibrating instruments."
ws.Cells(row + 2, 1).Value = "Marks: 8"
row = row + 4

' Totals
ws.Cells(row, 1).Value = "Totals:"
ws.Cells(row + 1, 1).Value = "Section A: 25 marks"
ws.Cells(row + 2, 1).Value = "Section B: 25 marks"
ws.Cells(row + 3, 1).Value = "Section C: 20 marks"
ws.Cells(row + 4, 1).Value = "Section D: 20 marks"
ws.Cells(row + 5, 1).Value = "Section E: 20 marks"
ws.Cells(row + 6, 1).Value = "Total: 110 marks (scaled to 100 for final grading)"
ws.Columns(1).EntireColumn.AutoFit

MsgBox "Exam export complete. Rectifier Vdc, transformer Vs computed; NAND table drawn.", vbInformation
End Sub

```

How to use

- Open Excel, press Alt+F11, Insert Module, paste the code.
- In Excel, select a blank worksheet.
- Run ExportExam_Electrical to generate the paper with computed answers and tables.

Do you want me to add an auto-marking macro and a rubric sheet (criteria for theory, practical, portfolio, and project evidence) so this becomes SAQA/DHET audit-ready end-to-en

Visual Basic toolkit: export exam sections, compute EE answers, and draw logic truth tables

What this does

- Writes your exam sections and answers to an Excel worksheet.

- Computes key results (impedance, rectifier average DC, transformer secondary voltage, energy over a cycle).
- Draws NAND and NOR truth tables in cells.
- Totals marks and notes scaling.

VBA code

Option Explicit

```
' ===== Math helpers =====

Private Function PiVal() As Double
    PiVal = WorksheetFunction.Pi()
End Function

' Impedance magnitude for R, XL, XC:  $Z = \sqrt{R^2 + (X_L - X_C)^2}$ 
Public Function ImpedanceMag(ByVal R As Double, ByVal XL As Double, ByVal XC As Double) As Double
    ImpedanceMag = Sqr(R ^ 2 + (XL - XC) ^ 2)
End Function

' Full-wave rectifier average DC output:  $V_{dc} = (2 * V_{peak}) / \pi$ 
Public Function RectifierVdc(ByVal Vpeak As Double) As Double
    RectifierVdc = (2# * Vpeak) / PiVal()
End Function

' Transformer secondary voltage:  $V_s = V_p * (N_s / N_p)$ 
Public Function TransformerVs(ByVal Vp As Double, ByVal Np As Double, ByVal Ns As Double) As Double
    TransformerVs = Vp * (Ns / Np)
End Function

' Energy over one cycle for  $P(t) = A * \sin^2(t)$  on  $[0, 2\pi]$ :  $E = A * \pi$ 
Public Function EnergyOverOneCycleSin2(ByVal A As Double) As Double
    EnergyOverOneCycleSin2 = A * PiVal()
End Function

' ===== Logic truth tables =====

' NAND output: NOT (A AND B)
Private Function NANDGate(ByVal a As Integer, ByVal b As Integer) As Integer
    If a = 1 And b = 1 Then NANDGate = 0 Else NANDGate = 1
End Function

' NOR output: NOT (A OR B)
Private Function NORGate(ByVal a As Integer, ByVal b As Integer) As Integer
    If a = 0 And b = 0 Then NORGate = 1 Else NORGate = 0
End Function

Public Sub DrawTruthTable(ByVal gateName As String, ByVal startRow As Long,
    ByVal startCol As Long)
```

```

    Dim ws As Worksheet: Set ws = ActiveSheet
    ws.Cells(startRow, startCol).Resize(1, 3).Value = Array("A", "B",
"Output")
    ws.Cells(startRow + 1, startCol).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 0, 1, 1))
    ws.Cells(startRow + 1, startCol + 1).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 1, 0, 1))

    Dim r As Long, a As Integer, b As Integer
    For r = startRow + 1 To startRow + 4
        a = ws.Cells(r, startCol).Value
        b = ws.Cells(r, startCol + 1).Value
        Select Case UCase$(gateName)
            Case "NAND": ws.Cells(r, startCol + 2).Value = NANDGate(a, b)
            Case "NOR": ws.Cells(r, startCol + 2).Value = NORGate(a, b)
            Case Else: ws.Cells(r, startCol + 2).Value = CVErr(xlErrNA)
        End Select
    Next r
    ws.Columns(startCol).Resize(, 3).AutoFit
End Sub

' ===== Exam export =====

Public Sub ExportExam_All()
    Dim ws As Worksheet, row As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
    row = 1

    ' Header and structure
    ws.Cells(row, 1).Value = "Electrical & Industrial Engineering – Exam
Assessment"
    row = row + 2
    ws.Cells(row, 1).Value = "Paper 1: Control/Organization/Math – Total 60
(scaled to 100)"
    row = row + 1
    ws.Cells(row, 1).Value = "Paper 2:
Foundational/Power/Transformers/Digital/Control – Total 100 (example)"
    row = row + 2

    ' ===== Paper 1: Section A – Control Systems (20 Marks) =====
    ws.Cells(row, 1).Value = "Section A: Control Systems (20 Marks)"
    row = row + 2

    ' Q1 Open vs closed loop
    ws.Cells(row, 1).Value = "Q1. Differentiate between open-loop and closed-
loop control systems."
    ws.Cells(row + 1, 1).Value = "Answer: Open-loop: no feedback. Closed-
loop: feedback compares output to setpoint and adjusts input."
    ws.Cells(row + 2, 1).Value = "Marks: 6"
    row = row + 4

    ' Q2 Feedback linearization
    ws.Cells(row, 1).Value = "Q2. How can feedback linearize non-linear
processes?"

```

```
ws.Cells(row + 1, 1).Value = "Answer: By feeding back a portion of output  
to compensate non-linearities, reducing distortion and improving  
predictability."
```

```
ws.Cells(row + 2, 1).Value = "Marks: 6"  
row = row + 4
```

```
' Q3 Closed-loop application
```

```
ws.Cells(row, 1).Value = "Q3. One practical closed-loop application."  
ws.Cells(row + 1, 1).Value = "Answer: DC motor speed regulation with  
tachometer feedback."
```

```
ws.Cells(row + 2, 1).Value = "Marks: 4"  
row = row + 4
```

```
' Q4 PI controller snippet (text)
```

```
ws.Cells(row, 1).Value = "Q4. Short C snippet for a PI controller  
generating PWM."
```

```
ws.Cells(row + 1, 1).Value = "Answer: See code block below."  
ws.Cells(row + 2, 1).Value = "Marks: 4"  
ws.Cells(row + 3, 1).Value = "int error, integral, output; int  
setpoint=1000; int Kp=2, Ki=1;"  
ws.Cells(row + 4, 1).Value = "void loop(){ error=setpoint-readSensor();  
integral+=error; output=Kp*error+Ki*integral; setPWM(output); }"  
row = row + 6
```

```
' ===== Paper 1: Section B – Industrial Organization & Supervision (20  
Marks) =====
```

```
ws.Cells(row, 1).Value = "Section B: Industrial Organization &  
Supervision (20 Marks)"  
row = row + 2
```

```
' Q5 Delegation principles
```

```
ws.Cells(row, 1).Value = "Q5. Two principles of effective delegation."  
ws.Cells(row + 1, 1).Value = "Answer: Assign by strengths; define  
responsibilities and expected outcomes."
```

```
ws.Cells(row + 2, 1).Value = "Marks: 6"  
row = row + 4
```

```
' Q6 Workflow design
```

```
ws.Cells(row, 1).Value = "Q6. Streamlined workflow to reduce  
bottlenecks."
```

```
ws.Cells(row + 1, 1).Value = "Answer: Parallelize  
(assembly/testing/packaging), add QC checkpoints, schedule with Gantt  
charts."
```

```
ws.Cells(row + 2, 1).Value = "Marks: 6"  
row = row + 4
```

```
' Q7 Safety techniques
```

```
ws.Cells(row, 1).Value = "Q7. Two workplace safety techniques."  
ws.Cells(row + 1, 1).Value = "Answer: Regular safety audits; training on  
hazard identification and emergency response."
```

```
ws.Cells(row + 2, 1).Value = "Marks: 4"  
row = row + 4
```

```
' Q8 Supervision application
```

```
ws.Cells(row, 1).Value = "Q8. Practical application in a workshop."
```

```

ws.Cells(row + 1, 1).Value = "Answer: Organize wiring/testing of control
panels with safety adherence."
ws.Cells(row + 2, 1).Value = "Marks: 4"
row = row + 4

```

```

' ===== Paper 1: Section C – Math Applications (20 Marks) =====
ws.Cells(row, 1).Value = "Section C: Mathematical Applications in
Engineering (20 Marks)"
row = row + 2

```

```

ws.Cells(row, 1).Value = "Q9. Energy in a capacitor."
ws.Cells(row + 1, 1).Value = "Answer:  $W = \frac{1}{2} C V^2$  (energy in electric
field)."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

```

```

ws.Cells(row, 1).Value = "Q10. Faraday's Law."
ws.Cells(row + 1, 1).Value = "Answer:  $\varepsilon = - \frac{d\Phi}{dt}$ ."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

```

```

Dim Ecycle50 As Double
Ecycle50 = EnergyOverOneCycleSin2(50)
ws.Cells(row, 1).Value = "Q11. Energy for  $P(t)=50 \sin^2(t)$  over one
cycle."
ws.Cells(row + 1, 1).Value = "Answer:  $E = 50 \pi \approx$  " & Format(Ecycle50,
"0.000") & " J."
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

```

```

' Divider
ws.Cells(row, 1).Value = String(60, "-")
row = row + 2

```

```

' ===== Paper 2: Foundational Electrical Theory (sample) =====
ws.Cells(row, 1).Value = "Section A: Foundational Electrical Theory (20
Marks)"
row = row + 2

```

```

ws.Cells(row, 1).Value = "Q1. Ohm's Law."
ws.Cells(row + 1, 1).Value = "Answer:  $V = I R$ ."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

```

```

ws.Cells(row, 1).Value = "Q2. KCL."
ws.Cells(row + 1, 1).Value = "Answer: Sum of currents entering a node
equals sum leaving."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

```

```

Dim Zmag As Double
Zmag = ImpedanceMag(10, 15, 5)
ws.Cells(row, 1).Value = "Q3. Impedance for  $R=10\Omega$ ,  $X_L=15\Omega$ ,  $X_C=5\Omega$ ."
ws.Cells(row + 1, 1).Value = "Answer:  $Z = \sqrt{10^2 + (15-5)^2} =$  " &
Format(Zmag, "0.00") & "  $\Omega$ ."

```

```

ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

' ===== Power Supplies & Amplifiers =====
ws.Cells(row, 1).Value = "Section B: Power Supplies & Amplifiers (20
Marks)"
row = row + 2

ws.Cells(row, 1).Value = "Q4. Zener diode function."
ws.Cells(row + 1, 1).Value = "Answer: Holds constant voltage in reverse
breakdown."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

Dim Vdc30 As Double
Vdc30 = RectifierVdc(30)
ws.Cells(row, 1).Value = "Q5. Full-wave rectifier average for Vpeak=30
V."
ws.Cells(row + 1, 1).Value = "Answer: Vdc =  $2 \cdot 30 / \pi \approx$  " & Format(Vdc30,
"0.00") & " V."
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

ws.Cells(row, 1).Value = "Q6. One amplifier application."
ws.Cells(row + 1, 1).Value = "Answer: Audio signal amplification."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' ===== Transformers =====
ws.Cells(row, 1).Value = "Section C: Transformers (20 Marks)"
row = row + 2

ws.Cells(row, 1).Value = "Q7. Principle of transformer action."
ws.Cells(row + 1, 1).Value = "Answer: Mutual inductance—changing primary
current induces secondary voltage."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

Dim Vs250 As Double
Vs250 = TransformerVs(250, 500, 100)
ws.Cells(row, 1).Value = "Q8. Transformer: Np=500, Ns=100, Vp=250 V.
Calculate Vs."
ws.Cells(row + 1, 1).Value = "Answer: Vs =  $250 \cdot (100/500) =$  " &
Format(Vs250, "0") & " V."
ws.Cells(row + 2, 1).Value = "Marks: 10"
row = row + 4

ws.Cells(row, 1).Value = "Q9. One industrial transformer application."
ws.Cells(row + 1, 1).Value = "Answer: Step-down for safe factory
distribution."
ws.Cells(row + 2, 1).Value = "Marks: 5"
row = row + 4

' ===== Digital Systems =====
ws.Cells(row, 1).Value = "Section D: Digital Systems (20 Marks)"

```

```

row = row + 2

ws.Cells(row, 1).Value = "Q10. NOR gate truth table."
ws.Cells(row + 1, 1).Value = "Answer: Table inserted below."
ws.Cells(row + 2, 1).Value = "Marks: 8"
DrawTruthTable "NOR", row + 3, 1
row = row + 9

ws.Cells(row, 1).Value = "Q11. Simplify:  $\bar{A}B + AB$ ."
ws.Cells(row + 1, 1).Value = "Answer: B (consensus: factor B;  $\bar{A} + A =$ 
1)."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

ws.Cells(row, 1).Value = "Q12. Convert binary 1101 to decimal."
ws.Cells(row + 1, 1).Value = "Answer: 13 (8 + 4 + 0 + 1)."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

' ===== Control & Transducers =====
ws.Cells(row, 1).Value = "Section E: Control Systems & Transducers (20
Marks)"
row = row + 2

ws.Cells(row, 1).Value = "Q15. Open vs closed loop."
ws.Cells(row + 1, 1).Value = "Answer: Open-loop no feedback; closed-loop
uses feedback to adjust input."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

ws.Cells(row, 1).Value = "Q16. Role of transducers."
ws.Cells(row + 1, 1).Value = "Answer: Convert physical quantities to
electrical signals for monitoring/control."
ws.Cells(row + 2, 1).Value = "Marks: 6"
row = row + 4

ws.Cells(row, 1).Value = "Q17. Two lab tasks for control competence."
ws.Cells(row + 1, 1).Value = "Answer: Wiring a control panel; calibrating
instruments."
ws.Cells(row + 2, 1).Value = "Marks: 8"
row = row + 4

' Totals and scaling notes
ws.Cells(row, 1).Value = "Totals:"
ws.Cells(row + 1, 1).Value = "Paper 1: 60 marks (scaled to 100)"
ws.Cells(row + 2, 1).Value = "Paper 2: example sections shown (~100
marks)"
ws.Columns(1).EntireColumn.AutoFit

MsgBox "Exam export complete. Calculations computed; NAND/NOR tables
inserted.", vbInformation
End Sub

```

How to use

- Open Excel, press Alt+F11, insert a Module, paste the code.
- Return to Excel, select a blank sheet.
- Run ExportExam_All to generate the paper with computed answers and logic tables.

If you want, I can add:

- A marking-rubric sheet with weighted criteria and auto-scaling to 100.
- A candidate response form and auto-marking macro for MCQs and numeric inputs.
- A simple flow painter to visualize the moderation workflow as a log
- Option Explicit
-
- ' === Math helpers ===
- Private Function PiVal() As Double
- PiVal = WorksheetFunction.Pi()
- End Function
-
- ' Energy over one cycle for $P(t) = A * \sin^2(t)$ on $[0, 2\pi]$: $E = A * \pi$
- Public Function EnergyOverOneCycleSin2(ByVal A As Double) As Double
- EnergyOverOneCycleSin2 = A * PiVal()
- End Function
-
- ' Resonance frequency: $fr = 1 / (2\pi\sqrt{LC})$
- Public Function ResonanceFreq(ByVal L As Double, ByVal C As Double) As Double
- ResonanceFreq = 1 / (2 * PiVal() * Sqr(L * C))
- End Function
-
- ' Full-wave rectifier average DC output: $V_{dc} = (2 * V_{peak}) / \pi$
- Public Function RectifierVdc(ByVal Vpeak As Double) As Double
- RectifierVdc = (2# * Vpeak) / PiVal()
- End Function
-
- ' Transformer secondary voltage: $V_s = V_p * (N_s / N_p)$
- Public Function TransformerVs(ByVal Vp As Double, ByVal Np As Double, ByVal Ns As Double) As Double
- TransformerVs = Vp * (Ns / Np)
- End Function
-
- ' === Logic truth tables ===
- Private Function NANDGate(ByVal a As Integer, ByVal b As Integer) As Integer
- If a = 1 And b = 1 Then NANDGate = 0 Else NANDGate = 1
- End Function
-
- Public Sub DrawNANDTruthTable(ByVal startRow As Long, ByVal startCol As Long)

```

• Dim ws As Worksheet: Set ws = ActiveSheet
• ws.Cells(startRow, startCol).Resize(1, 3).Value = Array("A", "B",
"Output")
• ws.Cells(startRow + 1, startCol).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 0, 1, 1))
• ws.Cells(startRow + 1, startCol + 1).Resize(4, 1).Value =
WorksheetFunction.Transpose(Array(0, 1, 0, 1))
•
• Dim r As Long
• For r = startRow + 1 To startRow + 4
• ws.Cells(r, startCol + 2).Value = NANDGate(ws.Cells(r,
startCol).Value, ws.Cells(r, startCol + 1).Value)
• Next r
• ws.Columns(startCol).Resize(, 3).AutoFit
• End Sub
•
• ' === Exam export ===
• Public Sub ExportExam_Comprehensive()
• Dim ws As Worksheet, row As Long
• Set ws = ActiveSheet
• ws.Cells.Clear
• row = 1
•
• ws.Cells(row, 1).Value = "Electrical & Industrial Engineering –
Comprehensive Exam Assessment"
• row = row + 2
• ws.Cells(row, 1).Value = "Total: 140 marks (scaled to 100)"
• row = row + 2
•
• ' Section F: Industrial Organization & Supervision
• ws.Cells(row, 1).Value = "Section F: Industrial Organization &
Supervision (20 Marks)"
• row = row + 2
• ws.Cells(row, 1).Value = "Q17. Two principles of effective
delegation."
• ws.Cells(row + 1, 1).Value = "Answer: Assign by strengths; define
responsibilities and expected outcomes."
• ws.Cells(row + 2, 1).Value = "Marks: 6"
• row = row + 4
•
• ws.Cells(row, 1).Value = "Q18. Streamlined workflow to reduce
bottlenecks."
• ws.Cells(row + 1, 1).Value = "Answer: Parallelize tasks, add QC
checkpoints, use Gantt charts."
• ws.Cells(row + 2, 1).Value = "Marks: 6"
• row = row + 4
•
• ws.Cells(row, 1).Value = "Q19. Two workplace safety techniques."
• ws.Cells(row + 1, 1).Value = "Answer: Regular safety audits; hazard
training."
• ws.Cells(row + 2, 1).Value = "Marks: 4"
• row = row + 4
•
• ws.Cells(row, 1).Value = "Q20. Practical application of
supervision."

```

- ws.Cells(row + 1, 1).Value = "Answer: Organize wiring/testing of control panels with safety adherence."
- ws.Cells(row + 2, 1).Value = "Marks: 4"
- row = row + 4
-
- ' Section G: Mathematical Applications
- ws.Cells(row, 1).Value = "Section G: Mathematical Applications (20 Marks)"
- row = row + 2
- ws.Cells(row, 1).Value = "Q21. Energy in a capacitor."
- ws.Cells(row + 1, 1).Value = "Answer: $W = \frac{1}{2} C V^2$."
- ws.Cells(row + 2, 1).Value = "Marks: 5"
- row = row + 4
-
- ws.Cells(row, 1).Value = "Q22. Faraday's Law."
- ws.Cells(row + 1, 1).Value = "Answer: $\varepsilon = - d\Phi/dt$."
- ws.Cells(row + 2, 1).Value = "Marks: 5"
- row = row + 4
-
- Dim Ecycle As Double
- Ecycle = EnergyOverOneCycleSin2(100)
- ws.Cells(row, 1).Value = "Q23. Energy for $P(t)=100 \sin^2(t)$ over one cycle."
- ws.Cells(row + 1, 1).Value = "Answer: $E = 100 \pi \approx$ " & Format(Ecycle, "0.000") & " J."
- ws.Cells(row + 2, 1).Value = "Marks: 10"
- row = row + 4
-
- ' Section A sample: resonance frequency
- ws.Cells(row, 1).Value = "Section A: Foundational Electrical Theory (20 Marks)"
- row = row + 2
- Dim fr As Double
- fr = ResonanceFreq(0.25, 100E-6)
- ws.Cells(row, 1).Value = "Q3. Resonance frequency for $L=0.25$ H, $C=100 \mu F$."
- ws.Cells(row + 1, 1).Value = "Answer: $fr \approx$ " & Format(fr, "0.0") & " Hz."
- ws.Cells(row + 2, 1).Value = "Marks: 10"
- row = row + 4
-
- ' Section B sample: rectifier average DC
- Dim Vdc As Double
- Vdc = RectifierVdc(40)
- ws.Cells(row, 1).Value = "Q5. Full-wave rectifier average for $V_{peak}=40$ V."
- ws.Cells(row + 1, 1).Value = "Answer: $V_{dc} = 2*40/\pi \approx$ " & Format(Vdc, "0.0") & " V."
- ws.Cells(row + 2, 1).Value = "Marks: 10"
- row = row + 4
-
- ' Section C sample: transformer calculation
- Dim Vs As Double
- Vs = TransformerVs(300, 600, 200)

- `ws.Cells(row, 1).Value = "Q8. Transformer: Np=600, Ns=200, Vp=300`
`V. Calculate Vs."`
- `ws.Cells(row + 1, 1).Value = "Answer: Vs = 300*(200/600) = " &`
`Format(Vs, "0") & " V."`
- `ws.Cells(row + 2, 1).Value = "Marks: 10"`
- `row = row + 4`
-
- `' Section D sample: NAND truth table`
`ws.Cells(row, 1).Value = "Q10. NAND gate truth table."`
- `ws.Cells(row + 1, 1).Value = "Answer: Table inserted below."`
- `ws.Cells(row + 2, 1).Value = "Marks: 8"`
- `DrawNANDTruthTable row + 3, 1`
- `row = row + 9`
-
- `ws.Cells(row, 1).Value = "Totals: 140 marks (scaled to 100)"`
- `ws.Columns(1).EntireColumn.AutoFit`
-
- `MsgBox "Comprehensive exam export complete. Calculations comp`

Visual Basic toolkit: logigram, algorigram, and exam export for control, supervision, and calculus

Overview

- Draws a logigram of a closed-loop control system stabilizing response.
- Implements an algorigram (decision logic) to iterate feedback until error threshold is met.
- Exports Sections F and G plus control items (Q13-Q16, Q21-Q23) to an Excel worksheet with answers and marks.
- Computes calculus results (inductor voltage for $i(t)=t^2$, energy for $P(t)=A\sin^2 t$).

Option Explicit

```
Public Sub ExportExam_Sustainable()
    Dim ws As Worksheet, r As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
    r = 1

    ' Header
    ws.Cells(r, 1).Value = "Exam Assessment: Sustainable Electrification &
    Education Frameworks"
    r = r + 2
```

```

ws.Cells(r, 1).Value = "Exam Structure: Section A 30 | Section B 30 |
Section C 20 | Section D 20 | Total 100"
r = r + 2

' ===== Section A: Electrification Strategy (30 Marks) =====
ws.Cells(r, 1).Value = "Section A: Electrification Strategy (30 Marks)"
r = r + 2

ws.Cells(r, 1).Value = "Q1. First step in assessing rural electrification
status?"
ws.Cells(r + 1, 1).Value = "Answer: Comprehensive analysis of
electrification rates; identify high-need regions via data and geotechnical
surveys."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q2. Difference between off-grid and micro-grid
solutions?"
ws.Cells(r + 1, 1).Value = "Answer: Off-grid: standalone SHS for remote
areas. Micro-grid: small hydropower integrated with local/new grid."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4

ws.Cells(r, 1).Value = "Q3. Electrical principles in SHS design?"
ws.Cells(r + 1, 1).Value = "Answer: Kirchhoff's Laws, impedance analysis,
power factor correction, fault detection."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4

ws.Cells(r, 1).Value = "Q4. Two safety components for
implementation/commissioning?"
ws.Cells(r + 1, 1).Value = "Answer: Circuit breakers; protective relays."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q5. Total project duration and phases?"
ws.Cells(r + 1, 1).Value = "Answer: 24 months: Phase 1 (Needs 1–3 m),
Phase 2 (Design 4–6 m), Phase 3 (Implementation 7–24 m)."
ws.Cells(r + 2, 1).Value = "Marks: 8"
r = r + 4

' ===== Section B: Sustainable Development & Community Impact (30
Marks) =====
ws.Cells(r, 1).Value = "Section B: Sustainable Development & Community
Impact (30 Marks)"
r = r + 2

ws.Cells(r, 1).Value = "Q6. Integration with national qualifications?"
ws.Cells(r + 1, 1).Value = "Answer: Training mapped to National Diploma
in Electrical Engineering (NQF 6, SAQA 111285) via NATED N1–N6."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4

ws.Cells(r, 1).Value = "Q7. Two socio-economic benefits of local
workforce localization?"

```

```
ws.Cells(r + 1, 1).Value = "Answer: Reduces unemployment; creates local
renewable service entrepreneurship."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q8. Reliable electricity and educational
outcomes?"
ws.Cells(r + 1, 1).Value = "Answer: Lighting and digital resources enable
extended study hours and modern tools."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q9. Two industries positively impacted?"
ws.Cells(r + 1, 1).Value = "Answer: Manufacturing; agriculture."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q10. Broader community goal beyond electricity?"
ws.Cells(r + 1, 1).Value = "Answer: Build local capacity, sustainable
employment, socio-economic empowerment."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4
```

```
' ===== Section C: Governance & Monitoring (20 Marks) =====
ws.Cells(r, 1).Value = "Section C: Governance & Monitoring (20 Marks)"
r = r + 2
```

```
ws.Cells(r, 1).Value = "Q11. Two key stakeholders?"
ws.Cells(r + 1, 1).Value = "Answer: Department of Energy; City Power."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q12. Two KPIs for project success?"
ws.Cells(r + 1, 1).Value = "Answer: Households connected; community
members trained/certified."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q13. Why transparent governance?"
ws.Cells(r + 1, 1).Value = "Answer: Ensures accountability, engagement,
adherence to timelines/budgets."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q14. Adaptive management tool?"
ws.Cells(r + 1, 1).Value = "Answer: KPIs with measurable data."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4
```

```
' ===== Section D: Education & Systemic Frameworks (20 Marks)
=====
ws.Cells(r, 1).Value = "Section D: Education & Systemic Frameworks (20
Marks)"
r = r + 2
```

```

ws.Cells(r, 1).Value = "Q15. Role of calculus in electrical engineering education?"
ws.Cells(r + 1, 1).Value = "Answer: Analyze dynamics, compute energy storage, optimize power systems."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4

```

```

ws.Cells(r, 1).Value = "Q16. One systemic vocational education challenge?"
ws.Cells(r + 1, 1).Value = "Answer: Exam irregularities and certificate backlogs."
ws.Cells(r + 2, 1).Value = "Marks: 6"
r = r + 4

```

```

ws.Cells(r, 1).Value = "Q17. How articulation benefits learners?"
ws.Cells(r + 1, 1).Value = "Answer: Clear pathways to higher qualifications and lifelong learning."
ws.Cells(r + 2, 1).Value = "Marks: 8"
r = r + 4

```

```

' Totals
ws.Cells(r, 1).Value = "Totals:"
ws.Cells(r + 1, 1).Value = "Section A: 30 marks"
ws.Cells(r + 2, 1).Value = "Section B: 30 marks"
ws.Cells(r + 3, 1).Value = "Section C: 20 marks"
ws.Cells(r + 4, 1).Value = "Section D: 20 marks"
ws.Cells(r + 5, 1).Value = "Total: 100 marks"
ws.Columns(1).EntireColumn.AutoFit

```

```

MsgBox "Sustainable Electrification & Education Frameworks exam exported.", vbInformation
End Sub
Option Explicit

```

```

Public Sub ExportExam_CompliancePlan()
    Dim ws As Worksheet, r As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
    r = 1

    ' Header
    ws.Cells(r, 1).Value = "Compliance Plan Quiz Assessment – Adherence to MIL-STD-11991B"
    r = r + 2

    ' ===== Section A: Multiple Choice =====
    ws.Cells(r, 1).Value = "Section A: Multiple Choice (2 marks each)"
    r = r + 2

    ws.Cells(r, 1).Value = "Q1. Primary purpose of PM&P Compliance Plan?"
    ws.Cells(r + 1, 1).Value = "Answer: Ensure system reliability, safety, and mission readiness."
    ws.Cells(r + 2, 1).Value = "Marks: 2"
    r = r + 4

```

```

ws.Cells(r, 1).Value = "Q2. Supplier type authorized by OCM?"
ws.Cells(r + 1, 1).Value = "Answer: Authorized Supplier."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q3. Document certifying product meets procurement
requirements?"
ws.Cells(r + 1, 1).Value = "Answer: Certificate of Conformance (C of C)."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q4. Non-destructive test for delamination?"
ws.Cells(r + 1, 1).Value = "Answer: Scanning Acoustic Microscopy (SAM)."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q5. Sourcing from non-authorized suppliers?"
ws.Cells(r + 1, 1).Value = "Answer: Prohibited unless Government-
approved."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

' ===== Section B: Short Answer =====
ws.Cells(r, 1).Value = "Section B: Short Answer (5 marks each)"
r = r + 2

ws.Cells(r, 1).Value = "Q6. Define 'Counterfeit Part'."
ws.Cells(r + 1, 1).Value = "Answer: Any part whose identity/pedigree has
been deliberately altered or misrepresented."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q7. Role of standardization in PM&P management."
ws.Cells(r + 1, 1).Value = "Answer: Minimizes distinct part
numbers/manufacturers, reduces costs, ensures performance."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q8. Function of GIDEP in counterfeit reporting."
ws.Cells(r + 1, 1).Value = "Answer: Provides formal channel for reporting
confirmed counterfeit parts/materials."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

' ===== Section C: Essay =====
ws.Cells(r, 1).Value = "Section C: Essay/Extended Response (10 marks
each)"
r = r + 2

ws.Cells(r, 1).Value = "Q9. Importance of supplier qualification."
ws.Cells(r + 1, 1).Value = "Answer: Verifies robust quality/manufacturing
processes; ensures compliance and reduces counterfeit risk."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

```



```
ws.Cells(r, 1).Value = "Q10. Multi-layered strategy for counterfeit avoidance/detection/reporting."
ws.Cells(r + 1, 1).Value = "Answer: Prevention (SAE AS5553/AS6174), Detection (SAM, Die Verification), Reporting (GIDEP, customer notification)."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4
```

```
' ===== Section D: Multiple Choice =====
```

```
ws.Cells(r, 1).Value = "Section D: Multiple Choice (2 marks each)"
r = r + 2
```

```
ws.Cells(r, 1).Value = "Q1. Review during COTS selection?"
ws.Cells(r + 1, 1).Value = "Answer: Parts list audit."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q2. Document after successful COTS qualification?"
ws.Cells(r + 1, 1).Value = "Answer: COTS Assembly Integration Report (CAIR)."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q3. Risk with silver-plated wire lacking ASTM B298?"
ws.Cells(r + 1, 1).Value = "Answer: Red plague corrosion."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q4. Prohibited material risk?"
ws.Cells(r + 1, 1).Value = "Answer: PVC plastics – flammability and toxic fumes."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q5. Purpose of Government-approved derating criteria?"
ws.Cells(r + 1, 1).Value = "Answer: Ensure safe operating margins and reliability."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4
```

```
' ===== Section E: Short Answer =====
```

```
ws.Cells(r, 1).Value = "Section E: Short Answer (5 marks each)"
r = r + 2
```

```
ws.Cells(r, 1).Value = "Q6. Role of Environmental Stress Screening (ESS)."
ws.Cells(r + 1, 1).Value = "Answer: Precipitates latent defects; ensures quality/reliability under stress."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q7. Why selenium rectifiers prohibited?"
```

```

ws.Cells(r + 1, 1).Value = "Answer: Prone to degradation and reliability
issues."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

```

```

ws.Cells(r, 1).Value = "Q8. Risks of improper soldering ceramic
capacitors."
ws.Cells(r + 1, 1).Value = "Answer: Thermal shock induces microcracks,
leading to premature failure."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

```

```

' ===== Section F: Essay =====
ws.Cells(r, 1).Value = "Section F: Essay/Extended Response (10 marks
each)"
r = r + 2

```

```

ws.Cells(r, 1).Value = "Q9. Importance of obsolescence management."
ws.Cells(r + 1, 1).Value = "Answer: Monitors end-of-life notices; enables
design refreshes; prevents disruptions and counterfeit risks."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

```

```

ws.Cells(r, 1).Value = "Q10. Rationale for prohibiting PVC plastics."
ws.Cells(r + 1, 1).Value = "Answer: PVC degrades, is flammable, emits
toxic fumes; compromises safety and reliability."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

```

```

' Totals
ws.Cells(r, 1).Value = "Total Marks: 50 (Sections A–C) + 50 (Sections D–
F) = 100"
ws.Columns(1).EntireColumn.AutoFit

```

```

MsgBox "Compliance Plan Quiz Assessment exported successfully.",
vbInformation
End Sub

```

```

Public Sub ExportExam_CompliancePlan_GtoJ()
Dim ws As Worksheet, r As Long
Set ws = ActiveSheet
ws.Cells.Clear
r = 1

```

```

' Header
ws.Cells(r, 1).Value = "PM&P Compliance Plan Quiz Assessment – Sections G
to J"
r = r + 2

```

```

' ===== Section G: Multiple Choice =====
ws.Cells(r, 1).Value = "Section G: Multiple Choice (2 marks each)"
r = r + 2

```

```

ws.Cells(r, 1).Value = "Q1. Derating factor for relay contact current
under motor loads (Table A XI)?"

```

```

ws.Cells(r + 1, 1).Value = "Answer: 0.20"
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q2. Why must dissimilar metals be avoided in
direct contact?"
ws.Cells(r + 1, 1).Value = "Answer: To prevent galvanic corrosion."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q3. IPC standard governing soldering for Class 3
PWAs?"
ws.Cells(r + 1, 1).Value = "Answer: IPC J-STD-001."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q4. Prohibited part banned due to
degradation/reliability concerns?"
ws.Cells(r + 1, 1).Value = "Answer: Selenium rectifiers."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q5. Why are mercury compounds prohibited?"
ws.Cells(r + 1, 1).Value = "Answer: Hazardous neurotoxins."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

' ===== Section H: Short Answer =====
ws.Cells(r, 1).Value = "Section H: Short Answer (5 marks each)"
r = r + 2

ws.Cells(r, 1).Value = "Q6. Rationale for prohibiting discrete diodes
without MIL PRF 19500 Category I bonds."
ws.Cells(r + 1, 1).Value = "Answer: Vulnerable to thermal cycling
failures; bond failure and intermittent loss of function."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q7. Why are ceramic capacitors with piezoelectric
output prohibited?"
ws.Cells(r + 1, 1).Value = "Answer: Generate unwanted voltage under
mechanical stress, causing noise/instability."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

ws.Cells(r, 1).Value = "Q8. Risks of cadmium plating in military
electronics."
ws.Cells(r + 1, 1).Value = "Answer: Toxic, sublimates under vacuum,
promotes fungus growth, degrades integrity."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

' ===== Section I: Essay =====
ws.Cells(r, 1).Value = "Section I: Essay/Extended Response (10 marks
each)"

```

```

r = r + 2

ws.Cells(r, 1).Value = "Q9. Importance of electronic part derating."
ws.Cells(r + 1, 1).Value = "Answer: Ensures safe margins, reduces stress,
extends life; meets MIL STD 11991B Appendix A."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

ws.Cells(r, 1).Value = "Q10. Rationale for prohibiting vacuum tubes."
ws.Cells(r + 1, 1).Value = "Answer: Fragile, degrade faster than solid
state, susceptible to shock/vibration; unsuitable for mission-critical
systems."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

' ===== Section J: Multiple Choice =====
ws.Cells(r, 1).Value = "Section J: Multiple Choice (2 marks each)"
r = r + 2

ws.Cells(r, 1).Value = "Q1. Phenomenon prevented by prohibition on
uncertified silver plated wire?"
ws.Cells(r + 1, 1).Value = "Answer: Red plague corrosion."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q2. Why are corrosive RTV adhesives/sealants
prohibited?"
ws.Cells(r + 1, 1).Value = "Answer: Release acetic acid vapors that
corrode metals."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q3. Organic materials prohibited due to
flammability/moisture absorption?"
ws.Cells(r + 1, 1).Value = "Answer: Cotton and linen."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q4. Why is mounting large components without
support prohibited?"
ws.Cells(r + 1, 1).Value = "Answer: Causes solder joint fatigue under
vibration."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

ws.Cells(r, 1).Value = "Q5. Risk with crimped aluminum aircraft wire?"
ws.Cells(r + 1, 1).Value = "Answer: Loose crimps due to thermal
expansion."
ws.Cells(r + 2, 1).Value = "Marks: 2"
r = r + 4

' Totals
ws.Cells(r, 1).Value = "Total Marks (Sections G-I): 50"
ws.Cells(r + 1, 1).Value = "Total Marks (Sections J): 10"

```

```

        ws.Cells(r + 2, 1).Value = "Combined with earlier sections: 150 marks
full exam paper"
        ws.Columns(1).EntireColumn.AutoFit

        MsgBox "Compliance Plan Quiz Assessment (Sections G–J) exported
successfully.", vbInformation
    End Sub
Option Explicit

Public Sub ExportExam_CompliancePlan_Kto0()
    Dim ws As Worksheet, r As Long
    Set ws = ActiveSheet
    ws.Cells.Clear
    r = 1

    ' Header
    ws.Cells(r, 1).Value = "PM&P Compliance Plan Quiz Assessment – Sections K
to 0"
    r = r + 2

    ' ===== Section K: Short Answer =====
    ws.Cells(r, 1).Value = "Section K: Short Answer (5 marks each)"
    r = r + 2

    ws.Cells(r, 1).Value = "Q6. Why PVC plastics are prohibited?"
    ws.Cells(r + 1, 1).Value = "Answer: PVC degrades via outgassing, becomes
brittle, contaminates components, flammable, toxic fumes."
    ws.Cells(r + 2, 1).Value = "Marks: 5"
    r = r + 4

    ws.Cells(r, 1).Value = "Q7. Risk posed by zinc whiskers."
    ws.Cells(r + 1, 1).Value = "Answer: Conductive filaments cause
catastrophic short circuits."
    ws.Cells(r + 2, 1).Value = "Marks: 5"
    r = r + 4

    ws.Cells(r, 1).Value = "Q8. Why certain IPC 7711/7721 repair methods
prohibited?"
    ws.Cells(r + 1, 1).Value = "Answer: Physically intrusive, compromise
laminate/pad integrity, reduce PWA reliability."
    ws.Cells(r + 2, 1).Value = "Marks: 5"
    r = r + 4

    ' ===== Section L: Essay =====
    ws.Cells(r, 1).Value = "Section L: Essay/Extended Response (10 marks
each)"
    r = r + 2

    ws.Cells(r, 1).Value = "Q9. Rationale for prohibiting moisture traps."
    ws.Cells(r + 1, 1).Value = "Answer: Moisture traps accelerate corrosion,
undermine solder joints and reliability."
    ws.Cells(r + 2, 1).Value = "Marks: 10"
    r = r + 4

```

```
ws.Cells(r, 1).Value = "Q10. Importance of prohibiting improper soldering  
of ceramic capacitors."
```

```
ws.Cells(r + 1, 1).Value = "Answer: Thermal shock causes microcracks and  
dielectric damage; latent defects lead to failures."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 10"
```

```
r = r + 4
```

```
' ===== Section M: Multiple Choice =====
```

```
ws.Cells(r, 1).Value = "Section M: Multiple Choice (2 marks each)"
```

```
r = r + 2
```

```
ws.Cells(r, 1).Value = "Q1. Why PVC insulation prohibited?"
```

```
ws.Cells(r + 1, 1).Value = "Answer: Degrades via outgassing, emits toxic  
fumes when burning."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 2"
```

```
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q2. Rationale for prohibiting sheet spring  
nuts/lock washers?"
```

```
ws.Cells(r + 1, 1).Value = "Answer: Vibration risks and shape retention  
issues."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 2"
```

```
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q3. Purpose of derating factor?"
```

```
ws.Cells(r + 1, 1).Value = "Answer: Reduce stress and increase  
reliability."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 2"
```

```
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q4. Diode rated 100V, derating 0.80, safe  
voltage?"
```

```
ws.Cells(r + 1, 1).Value = "Answer: 80 V."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 2"
```

```
r = r + 4
```

```
' ===== Section N: Short Answer =====
```

```
ws.Cells(r, 1).Value = "Section N: Short Answer (5 marks each)"
```

```
r = r + 2
```

```
ws.Cells(r, 1).Value = "Q5. Why corrosive RTV adhesives/sealants  
prohibited?"
```

```
ws.Cells(r + 1, 1).Value = "Answer: Emit acetic acid vapors, corrode  
metals, compromise reliability."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 5"
```

```
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q6. Analogy between redlining car engine and max  
ratings."
```

```
ws.Cells(r + 1, 1).Value = "Answer: Operating at max stress accelerates  
failure; derating prevents this."
```

```
ws.Cells(r + 2, 1).Value = "Marks: 5"
```

```
r = r + 4
```

```
ws.Cells(r, 1).Value = "Q7. Three stress parameters managed by derating."
```

```

ws.Cells(r + 1, 1).Value = "Answer: Power dissipation, voltage, current."
ws.Cells(r + 2, 1).Value = "Marks: 5"
r = r + 4

' ===== Section 0: Essay =====
ws.Cells(r, 1).Value = "Section 0: Essay/Extended Response (10 marks
each)"
r = r + 2

ws.Cells(r, 1).Value = "Q8. Military prohibitions on small parts
illustrate second order effects."
ws.Cells(r + 1, 1).Value = "Answer: Banned items (PVC, nuts, adhesives)
introduce hidden risks; prohibition enforces reliability culture."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

ws.Cells(r, 1).Value = "Q9. Role of derating in long term reliability."
ws.Cells(r + 1, 1).Value = "Answer: Reduces stresses, extends life,
lowers failure probability; mandatory in aerospace/military contexts."
ws.Cells(r + 2, 1).Value = "Marks: 10"
r = r + 4

' Totals
ws.Cells(r, 1).Value = "Total Marks (Sections K-0): 50"
ws.Cells(r + 1, 1).Value = "Combined with earlier sections: 200 marks
full exam paper"
ws.Columns(1).EntireColumn.AutoFit

MsgBox "Compliance Plan Quiz Assessment (Sections K-0) exported
successfully.", vbInformation
End Sub

```